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A

HISTORY

OF

INVENTIONS AND DISCOVERIES.

BY JOHN BECKMANN,

Public Professor of Economy in the University of Gottingen.

TRANSLATED FROM THE GERMAN,

BY WILLIAM JOHNSTON.

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ERRATA.

VOL. III.

Page 6, line 12, *for* Codrus *read* Cordus.
P. 134, l. 17, *for* third part, *read* fourth part.
P. 297, l. 8, *for* popes, *read* prieſts.
P. 306, in the epigram from Petronius, laſt line but two, *for* Ex *read* Et.
P. 385, laſt line, *for* This inſtrument, *read* This part of the inſtrument.

HISTORY

OF

INVENTIONS.

GARDEN-FLOWERS.

MOST of the flowers introduced into our gardens, and now cultivated either on account of their beauty, or the pleaſantneſs of their ſmell, have been procured from plants which grew wild, and which have been changed, or, according to the opinion of floriſts, improved, by the art of the gardener. The greater part of them however came originally from diſtant countries, where they grow, in as great perfection as ours, without the aſſiſtance of man. Though we often find mention of flowers in the works of the Greeks and the Romans, it appears that they were contented with thoſe only which grew in their neighbourhood. I do not remember to have read that they ever took the trouble to form gardens for the particular purpoſe of

rearing in them foreign flowers or plants. But even ſuppoſing that I may be miſtaken, for I do not pretend to have examined this ſubject very minutely, I think I may with great probability venture to aſſert, that the modern taſte for flowers came from Perſia to Conſtantinople, and was imported thence to Europe, for the firſt time, in the ſixteenth century. At any rate, we find that the greater part of the productions of our flower-gardens were conveyed to us by that channel. Cluſius and his friends, in particular, contributed very much to excite this taſte; and the new plants brought from both the Indies by the travellers who then continued ſtill more frequently to viſit theſe countries, tended to increaſe it. That period alſo produced ſome ſkilful gardeners, who carried on a conſiderable trade with the roots and ſeeds of flowers; and theſe likewiſe aſſiſted to render it more general. Among theſe were John and Veſpaſian Robin, gardeners to Henry IV of France *, and Emanuel Sweert, gardener to the emperor Rodolphus II †, from whom the botaniſts of that time procured many rarities, as appears from different paſſages of their works. As this taſte for flowers prevails more at preſent than at any former period, a ſhort hiſtory of ſome of the objects of it may not be diſagreeable, perhaps, to many of my readers.

* See Haller's Bibliotheca botan. i. p. 398.

† Ibid. p. 411.

Simon

Simon de Tovar, a Spaniſh phyſician, brought the tuberoſe to Europe before the year 1594 from the Eaſt Indies, where it grows wild in Java and Ceylon, and ſent ſome roots of it to Bernard Paludanus *, who firſt made the flower publicly known, in his annotations on Linſchoten's voyage †. The full tuberoſes were firſt procured from ſeed by one Le Cour, at Leyden, who kept them ſcarce for ſome years, by deſtroying the roots, that they might not become common ‡. The propagation of them in moſt countries is attended with difficulties; but in Italy, Sicily, and Spain, it requires no trouble; and at preſent the Genoeſe ſend a great many roots to England, Holland, and Germany. The oldeſt botaniſts claſſed them among the hyacinths, and their modern name *polianthes tuberoſa* was given them by Linnæus in *Hortus Cliffortianus*.

The auricula, *primula auricula*, grows wild among the long moſs covered with ſnow, on the confines of Switzerland and Steyermark ||, whence it was brought to our gardens, where, by art and accident, it has produced more varieties than any other

* Papons Reiſe durch die Provence. Leipzig 1783, 8vo p. 332.

† Navigatio et itinerarium in Orientalem Indiam. Hagæ 1599, fol.

‡ Miller's Gärtner-Lexicon, iii. p. 633.

|| Haller, Hiſtor. Stirpium, i. p. 272. n. 612.

ſpecies of flower. I do not know who firſt tranſplanted it from its native ſoil. Pluche * ſays only that ſome roots were pulled up by Walloon merchants, and carried to Bruſſels. This much, at any rate, is certain, that it was firſt cultivated with care by the Flemings, who were very ſucceſsful in propagating it. Profeſſor Weiſmantel, who deſerves to be ranked amongſt the principal writers on flowers †, ſays, that the auricula was deſcribed and celebrated by Ovid, Pliny, and Columella; but this I much doubt. The botaniſts even of the laſt century, who ſearched for plants in the works of the ancients with great diligence, and who took the liberty of making very bold aſſertions, were not able to find any name that would correſpond with the auricula; for the conjecture of Fabius Columna, that it is the *aliſma* of Dioſcorides, is highly improbable, as that Grecian author extols his plant, which was fond of water, on account of its medicinal virtues only. In the time of Cluſius, moſt of the varieties of the auricula were ſcarce.

The common fritillary, or chequered lily, *fritillaria meleagris*, was firſt obſerved in ſome parts of France, Hungary, Italy, and other warm countries, and introduced into gardens about the middle of

* Schauplatz der natur, ii. p. 49.

† Des Blumiſten zweyter theil. Erfurt 1783, 8vo. p. 5.

the

the ſixteenth century. At firſt it was called *lilium variegatum*; but Noel Capperon, an apothecary at Orleans, who collected a great many ſcarce plants, gave it the name of *fritillaria*, becauſe the red or reddiſh-brown ſpots of the flower form regular ſquares, much like thoſe of a cheſs-board. It was firſt called *meleagris* by Dodonæus, becauſe the feathers of that fowl are variegated almoſt in the ſame manner *.

The roots of the magnificent crown imperial, *fritillaria imperialis*, were about the middle of the ſixteenth century brought from Perſia to Conſtantinople, and were carried thence to the Emperor's garden at Vienna, from which they were diſperſed all over Europe. This flower was firſt known by the Perſian name *tuſac*, until the Italians gave it that of *corona imperiale* †, or crown imperial. I have ſomewhere read, that it has been imagined that the figure of it is to be found repreſented on coins of Herod, and that, on this account, it has been conſidered as the lily ſo much celebrated in the Scripture.

The Perſian lily, *fritillaria Perſica*, which is nearly related to it, was made known almoſt about the ſame time. The bulbs or roots were brought

* Cluſii Hiſtor. plant. ii. p. 154.

† Cluſii Hiſt. plant. i. p. 128. Dodonæi Pempt. p. 202.

from Suſa to Conſtantinople, and for that reaſon it was formerly called *lilium Suſianum* *.

African and French marygolds, *tagetes erecta* and *patula*, were, according to the account of Dodonæus and others, brought from Africa to Europe, at the time when the emperor Charles V carried his arms againſt Tunis. This however is improbable; for theſe plants are indigenous in South America, and were known to botaniſts before that period under the name of *caryophyllus Indicus*, from which is derived the French appellation *oeillet d'Inde*. Codrus calls them, from their native country, *tanacetum Peruvianum* †.

Among the moſt beautiful ornaments of our gardens, is the bella-donna lily, *amaryllis formoſiſſima*, the flower of which, compoſed of ſix petals, is of a deep-red colour, and in a ſtrong light, or when the ſun ſhines upon it, has an agreeable yellow luſtre like gold. The firſt roots of it ever ſeen in Europe were procured in 1593, on board a ſhip which had returned from South America, by Simon de Tovar, a phyſician at Seville. In the year following, he ſent a deſcription of the flower to Cluſius; and as he had at the ſame time ſent

* Cluſii Hiſt. plant. p. 130.

† Dodonæi Florum hiſtoria, p. 62. Bauhini Hiſtor. plant. iii. 1. p. 98.

ſome

ſome roots to Bernard Paludanus, and count d'Aremberg, the former ſent a dried flower, and the latter an accurate drawing of it to Cluſius, who publiſhed it in 1601 *. One of the Robins gave in 1608 a larger and more correct figure, which was afterwards copied by Bry, Parkinſon, and Rudbeke; but a complete deſcription, with a good engraving, was publiſhed in 1742, by Linnæus †, who in 1737 gave to that genus the name by which they are known at preſent ‡. Sweert, Bauhin, and Rudbeke, are evidently miſtaken in aſſigning the Eaſt Indies as the original country of this plant; and Broke ||, who was not a botaniſt, but only a floriſt, is equally wrong in making it a native of the Levant. Tovar received it from South America, where it was found by Plumier and Barrere, and at a later period by Thiery de Menonville alſo §. At firſt it was claſſed with the narciſſus, and it was afterwards called *lilio-narciſſus*, becauſe its flower reſembled that of the lily, and its roots thoſe of the narciſſus. It was named *flos-Jacobæus*, becauſe ſome imagined

* Hiſt. plantar. i. p. 157.

† Abhandlungen der Schwediſchen Akademie, iv. p. 116.

‡ Hortus Cliffort. p. 135.

|| Beobachtungen von einigen blumen. Leipzig 1769, 8vo.

§ Barrere, Hiſt. naturelle de la France Equinoxiale, ſpec. 8. Traité de la culture du Nopal, par Thiery de Menonville. Au Cap-François 1787, 8vo.

that they diſcovered in it a likeneſs to the badge of the knights of the order of St. James in Spain, whoſe founder, in the fourteenth century, could not indeed have been acquainted with this beautiful amaryllis.

Another ſpecies of this genus is the Guernſey lily, *amaryllis Sarnienſis*, which in the magnificence of its flower is not inferior to the former. This plant was brought from Japan, where it was found by Kæmpfer *, and alſo by Thunberg †, who viſited that country about twenty years ago. It was firſt cultivated in the beginning of the ſeventeenth century in the garden of John Morin, at Paris, where it blowed, for the firſt time, on the 7th of October 1634. It was then made known by Jacob Cornutus, under the name of *narciſſus Japonicus flore rutilo* ‡. After this it was again noticed by John Ray || an Engliſhman, in 1665, who

* Amœnitat. exoticæ, p. 872.

† Flora Japonica, p. 132. The author ſays that the Japaneſe conſider the bulbs as poiſonous.

‡ Inter omnes narciſſos, qui hactenùs inviſi apud nos extiterunt, prima, ut arbitror, auctoritas nobiliſſimo huic generi debetur, quod paucis abhinc annis ex Japonia allatum, ſtrenui admodum et nullis ſumptibus parcentis viri Johannis Morini cultura, tandem in florem proſiluit ſeptimo menſis Octobris, anno Dom. 1634. *Jac. Cornuti Canadenſium plantarum aliarumque nondum editarum hiſtoria.* Paris 1635, 4to. p. 157.

|| A complete Florilege, furniſhed with all the requiſites belonging to a floriſt. London 1665, fol. lib. i. cap. 10, p. 74.

called

called it the *Guernſey lily*, which name it ſtill very properly bears. A ſhip returning from Japan was wrecked on the coaſt of Guernſey, and a number of the bulbs of this plant, which were on board, being caſt on ſhore, took root in that ſandy ſoil. As they ſoon increaſed and produced beautiful flowers, they were obſerved by the inhabitants, and engaged the attention of Mr. Hatton, the governor's ſon, whoſe botanical knowledge is highly ſpoken of by Ray, and who ſent roots of them to ſeveral of his friends who were fond of cultivating curious plants *. Of this elegant flower Dr. Douglaſs gave a deſcription and figure in a ſmall treatiſe publiſhed in 1725 †, which is quoted by Linnæus in his *Bibliotheca*, but not by Haller.

* Ejus radices ex Japonica allatæ, et ex nave naufraga, Batavica an Anglica incertum, ejectæ in littus arenoſum inſulæ Guernſey;—ibi, inquam, bulbi incuria projecti in litus arenoſum, inter ſparta maritima, et vento fortiore arenam eo pellente, qua demum prædicti bulbi tecti poſt aliquot annos ſumma cum admiratione flores rutilos amplos et elegantes ſponte dedere. Hoc flore detecto, aliquot annis poſtea radices plurimas communicavit botanicis et elegantium florum cultoribus dominus Carolus Hatton, filius natu ſecundus nobiliſſimi viri Chriſtophori Hatton, baronis de Hatton, et inſulæ Guernſey prædictæ gubernatoris. *Rob. Moriſoni Plantarum hiſtoria*, pars ſecunda, Oxonii 1680, fol. ſect. 4, p. 367.

† Lilium Sarnienſe, or a Deſcription of the Guernſey lily. To which is added the botanical diſſection of the coffee-berry. By Dr. James Douglaſs, London 1725. fol. Linnæi Bibliotheca botanica. Halæ 1747, 8vo. p. 32.

Of

Of the numerous genus of the ranunculus, florists, to speak in a botanical sense, have obtained a thousand different kinds *; for, according to the manner in which they are distinguished by gardeners, the varieties are infinite and increase almost every summer, as those with half-full flowers bear seed which produces plants that from time to time divide themselves into new kinds that exhibit greater or uncommon beauties. The principal part of them, however, and those most esteemed were brought to us from the Levant. Some were carried from that part of the world so early as in the time of the Crusades; but most of them have been introduced into Europe from Constantinople since the end of the sixteenth century, particularly the Persian ranunculus †, the varieties of which, if I am not mistaken, hold at present the first rank. Clusius describes both the single and the full flowers as new rarities ‡. This flower was in the highest repute during the time of Mahomet IV. His Grand Vizir, Cara Mustapha, well known by his hatred against the Christians and the siege of Vienna in 1683, wishing to turn the Sultan's thoughts to some milder amusement than that of the chace, for which he had a strong passion, diverted his attention to flowers; and, as he re-

* Millers Gärtner-Lexicon, iii. p. 761.

† Ranunculus Asiaticus Linnæi.

‡ Histor. plant. rar. i. p. 241.

marked that the Emperor preferred the ranunculus to all others, he wrote to the different Pachas throughout the whole kingdom to ſend him ſeeds or roots of the moſt beautiful kinds. The Pachas of Candia, Cyprus, Aleppo and Rhodes paid moſt regard to this requeſt; and the elegant flowers which they tranſmitted to court were ſhut up in the Seraglio as unfortunate offerings to the voluptuouſneſs of the Sultan, till ſome of them, by the force of money, were at length freed from their impriſonment. The ambaſſadors from the European courts, in particular, made it their buſineſs to procure roots of as many kinds as they could, which they ſent to their different ſovereigns. Marſeilles, which at that period carried on the greateſt trade to the Levant, received on this account theſe flowers very early, and a perſon there, of the name of Malaval, is ſaid to have contributed very much to diſperſe them all over Europe *.

* Tournefort, Voyage du Levant, vol. ii. p. 15. *Traité des renoncules (par D'Ardene)*, Paris 1746, 8vo.; and an extract from it in *Hamburg. magazin*, i. p. 596. *Pluche, Schauplatz der natur*, i. p. 71.

LENDING-HOUSES.

IT appears ſingular to us, at preſent, that it ſhould have been once conſidered unlawful to receive intereſt for lent money; but this circumſtance will excite no wonder when the reaſon of it is fully explained. The different occupations by which one can maintain a family without robbery and without war, were at early periods neither ſo numerous nor ſo productive as in modern times; and thoſe who borrowed money required it only for immediate uſe, to relieve their neceſſities or to procure the conveniencies of life; and thoſe who advanced it to ſuch indigent perſons did ſo either through benevolence or friendſhip. The caſe now is widely different. With the aſſiſtance of borrowed money people enter into buſineſs, and carry on trades, from which by their abilities, diligence, or good fortune, ſo much profit ariſes that they ſoon acquire more than is requiſite for their daily ſupport; and under theſe circumſtances the lender may, undoubtedly, receive for the beneficial uſe of his money a certain remuneration, eſpecially as he himſelf might have employed it to advantage; and as by lending it he runs the riſk of loſing either the whole or a part of his

his capital, or at leaſt of not receiving it again ſo ſoon as he may have occaſion for it.

Lending on intereſt, therefore, muſt have become more uſual in proportion as trade, manufactures and the arts were extended; or as the art of acquiring money by money became more common: but it long continued to be deteſted, becauſe the ancient abhorrence againſt it was by an improper conſtruction of the Moſaic law converted into a religious prejudice *, which, like many other prejudices more pernicious, was ſtrengthened and confirmed by ſevere papal laws. The people, however, who often deviſe means to render the faults of their legiſlators leſs hurtful, concealed this practice by various inventions, ſo that neither the borrower nor lender could be puniſhed, nor the giving and receiving of intereſt be prevented. As it was of more benefit than prejudice to trade, the impolicy of the prohibition became always more apparent; it was known that the new-invented uſurious arts under which it was privately followed would occaſion greater evils than thoſe which had been apprehended from lending on intereſt publicly; it was perceived alſo that the Jews, who were not affected by papal maledictions, foreign-

* J. D. Michaelis Diſſertatio de mente et ratione legis Moſaicæ uſuram prohibentis, in Syntagma commentationum, ii. p. 9; and his Moſaiſches recht. iii. p. 86.

ers,

ers, and a few natives who had neither religion nor conſcience, and whom the Church wiſhed leaſt of all to favour, were thoſe principally enriched by it.

In no place was this inconvenience more felt than at the Romiſh court, even at a time when it boaſted of divine infallibility; and nowhere was more care employed to remove it. A plan, therefore, was at length deviſed, by which the evil, as was ſuppoſed, would be baniſhed. A capital was collected from which money was to be lent to the poor for a certain period on pledges without intereſt. This idea was indeed not new; for ſuch eſtabliſhments had long before been formed and ſupported by humane princes. The emperor Auguſtus, we are told, converted into a fund the ſurplus of the money which aroſe to the State from the confiſcated property of criminals, and lent ſums from it, without intereſt, to thoſe who could pledge value equal to double the amount *. Tiberius alſo advanced a large capital, from which thoſe were ſupplied with money for three years, who could give ſecurity on lands equivalent to twice the value †. Alexander Severus reduced the intereſt

* Quoties ex damnatorum bonis pecunia ſuperflueret, uſum ejus gratuitum iis qui cavere in duplum poſſent, ad certum tempus indulſit. *Sueton. Vita Auguſti*, cap. 41.

† Tulit opem Cæſar, diſpoſito per menſas millies ſeſtertio, factaque mutuandi copia ſine uſuris per triennium, ſi debitor populo

intereſt of money by lending money at a low rate, and advancing ſums to the poor without intereſt to purchaſe lands, and agreeing to receive payment from the produce of them *.

Theſe examples of the ancients were followed in modern Italy. In order to collect money, the Popes conferred upon thoſe who would contribute towards that object a great many fictitious advantages, which at any rate coſt them nothing. By bulls and holy water they diſpenſed indulgences and eternal ſalvation; they permitted burdenſome vows to be converted into donations to lending-houſes; and authorized the rich who advanced them conſiderable ſums to diſinherit ſuch of their children as were unmarried. As an eſtabliſhment of this kind required a great many ſervants, they endeavoured to procure theſe alſo on the ſame conditions; and they offered, beſides the abovemen-

pulo in duplum prædiis caviſſet. Sic refecta fides, et paulatim privati quoque creditores reperti. *Taciti Annal.* vi. 17, p. 361. Publice munificentiam bis omnino exhibuit: propoſito millies HS. gratuito in triennii tempus. *Sueton. Vita Tiberii*, cap. 48, p. 558. Tiberius rem fœnerariam temperavit, millieſque ſeſtertium reipublicæ largitus eſt, quam pecuniam ſenatorii ordinis viri indigentibus ſine uſura ad tres annos mutuo darent. *Dio Caſſius*, lviii. 21, p. 893.

* Fœnus publicum trientarium exercuit, ita ut pauperibus pleriſque ſine uſuris pecunias dederit ad agros emendos, reddendas de fructibus. *Ælius Lamprid. Vita Alex. Severi*, cap. 21, p. 528.

tioned

tioned benefits, a great many others not worth notice, to thoſe who would engage to diſcharge gratis the buſineſs of their new undertaking; but in caſes of neceſſity they were to receive a moderate ſalary from the funds. This money was lent without intereſt for a certain time to the poor only, provided they could depoſit proper pledges of ſufficient value.

It was, however, ſoon obſerved that an eſtabliſhment of this kind could neither be of extenſive uſe nor of long duration. In order to prevent the ſecret lending of money, by the uſurious arts which had begun to be practiſed, it was neceſſary that it ſhould advance ſums not only to thoſe who were poor in the ſtricteſt ſenſe of the word, but to thoſe alſo who, to ſecure themſelves from poverty, wiſhed to undertake and carry on uſeful employments, and who for that purpoſe had need of capitals. However powerful the attractions might be, which, on account of the religious folly that then prevailed, induced people to make large contributions, they gradually loſt their force, and the latter were leſſened in proportion, eſpecially as a ſpirit of reformation began ſoon after to break out in Germany, and to ſpread more and more into other countries. Even if a lending-houſe ſhould not be exhauſted by the maintenance of its ſervants, and various accidents that could not be guarded againſt, it was ſtill neceſſary, at any rate, to bor-

row

row as much money at intereſt as would be ſufficient to ſupport the eſtabliſhment. As it was impoſſible that it could relieve all the poor, the only method to be purſued was to prevent their increaſe, by encouraging trade, and by ſupplying thoſe with money who wanted only a little to enable them to gain more, and who were in a condition and willing to pay a moderate intereſt. The pontiffs, therefore, at length reſolved to allow the lending-houſes to receive intereſt, not for the whole capitals which they lent, but only for a part, merely that they might raiſe as much money as might be ſufficient to defray their expences; and they now, for the firſt time, adopted the long-eſtabliſhed maxim, that thoſe who enjoy the benefits ſhould aſſiſt to bear the burthen—a maxim which very clearly proves the legality of intereſt. When this opening was once found, one ſtep more only was neceſſary to put the lending-houſes on that judicious footing on which they would in all probability have been put by the inventor himſelf, had he not been under the influence of prejudice. In order that they might have ſufficient ſtock in hand, it was thought proper to give to thoſe who ſhould advance them money a moderate intereſt, which they prudently concealed by blending it with the unavoidable expences of the eſtabliſhment, to which it indeed belonged, and which their debtors, by the practice a little before intro-

duced, were obliged to make good. The lending-houſes, therefore, gave and received intereſt. But that the odious name might be avoided, whatever intereſt was received, was ſaid to be *pro indemnitate*; and this is the expreſſion made uſe of in the papal bull.

All this, it muſt be confeſſed, was deviſed with much ingenuity: but perſons of acuteneſs ſtill diſcovered the concealed intereſt; and a violent conteſt ſoon aroſe reſpecting the legality of lending-houſes, in which the greateſt divines and juriſts of the age took a part; and by which the old queſtion, whether one might do any thing wicked, or eſtabliſh intereſt, in order to effect good, was again revived and examined. Fortunately for the pontifical court, the folly of mankind was ſtill ſo great that a bull was ſufficient to ſuppreſs, or at leaſt to ſilence, the ſpirit of enquiry. The Pope declared the holy mountains of piety, *ſacri monti de pietà*, to be legal; and threatened thoſe with his vengeance who dared to entertain any farther doubts on the ſubject. All the cities now haſtened to eſtabliſh lending-houſes; and their example was at length followed in other countries. Such, in a general view, is the hiſtory of theſe eſtabliſhments: I ſhall now confirm it by the neceſſary proofs.

When

When under the appellation of *lending-houſe* we underſtand a public eſtabliſhment where any perſon can borrow money upon pledges, either for or without intereſt, we muſt not compare it to the *tabernæ argentariæ* or *menſæ numulariæ* of the Romans. Theſe were banking-houſes, at which the State and rich people cauſed their revenues to be paid, and on which they gave their creditors orders either to receive their debts in money, or to have the ſums transferred in their own name, and to receive ſecurity for them. To aſſign over money and to pay money by a bill were called *perſcribere* and *reſcribere*; and an aſſignment or draft was called *attributio*. Theſe *argentarii*, *menſarii*, *numularii*, *collybiſtæ* and *trapezitæ* followed the ſame employment, therefore, as our caſhiers or bankers. The former, like the latter, dealt in exchanges and diſcount; and in the ſame manner alſo they lent from their capital on intereſt, and gave intereſt themſelves, in order that they might receive a greater. Thoſe who among the ancients were enemies to the lending of money on intereſt brought theſe people alſo into ſome diſrepute; and the contempt entertained for them was probably increaſed by prejudice, though thoſe *numarii* who were eſtabliſhed by government as public caſhiers held ſo exalted a rank that ſome of them became conſuls. Such banking-houſes occur in the Italian States in the middle ages, about the year 1377. They were called *apothecæ ſeu caſanæ feneris*,

ris *, and in Germany *wechſelbanke*, banks of exchange; but they were not lending-houſes in the ſenſe in which I here underſtand them.

Equally diſtinct alſo from lending-houſes were thoſe banks eſtabliſhed in the fourteenth century, in many cities of Italy, ſuch, for example, as Florence, in order to raiſe public loans. Thoſe who advanced money on that account received an obligation and monthly intereſt, which on no pretext could be refuſed, even if the creditor had been guilty of any crime. Theſe obligations were ſoon ſold with advantage, but oftener with loſs; and the price of them roſe and fell like that of the Engliſh ſtocks, but not ſo rapidly; and theologiſts diſputed whether one could with a ſafe conſcience purchaſe an obligation at leſs than the current value, from a proprietor who was obliged to diſpoſe of it for ready ſpecie. If the State was deſirous or under the neceſſity of repaying the money, it availed itſelf of that regale called by Leyſer *regale falſæ monetæ*, and returned the capital in money of an inferior value. This eſtabliſhment was confirmed, at leaſt at Florence, by the Pontiff, who ſubjected thoſe who ſhould commit

* Oſſervazioni iſtoriche di Dominico M. Manni circa i ſigilli antichi dei ſecoli baſſi, vol. xxvii. p. 86. The author here quotes from an ancient city-book the following paſſage: Franciſcus fenerator pro ſe et apotheca ſeu caſana fenoris, quam tenebat in via Quattro Pagoni, &c.

any

any fraud in it, to eccleſiaſtical puniſhment and a fine, which was to be carried to the Papal treaſury: but long before that period, the republic of Genoa had raiſed a loan by mortgaging the public revenues. I have been more particular on this ſubject becauſe Le Bret * calls theſe banks very improperly lending-houſes; and in order to ſhew to what a degree of perfection the princely art of contracting and paying debts was brought ſo early as the fourteenth century.

Thoſe who have as yet determined the origin of lending-houſes with the greateſt exactneſs place it, as Dorotheus Aſcianus, that is Matthias Zimmermann †, does, in the time of Pope Pius II or Paul II, who filled the papal chair from 1464 to 1471; and the reaſon for ſuppoſing it to have been under the pontificate of the latter is, becauſe

* Algemeine Welthiſtorie, xlv. p. 10.

† This theologian, born at Eperies in Hungary, in 1625, was driven from his native country on account of his religion, and died ſuperintendant at Meiſſe in 1689. He wrote, beſides other works: *Dorothei Aſciani Montes pietatis Romanenſes hiſtorice, canonice et theologice detecti.* Lipſiæ 1670, 4to. This book is at preſent very ſcarce. I ſhall take this opportunity of mentioning alſo the following, becauſe many who have written on lending-houſes have quoted it, though they never ſaw it: *Montes pietatis Romanenſes, das iſt, die Berg der Frombeit oder Gottesforcht in der ſtadt Rom.* Durch Elychnium Gottlieb. Straſburg 1608, 8vo. It contains nothing of importance that may not be found in Aſcianus.

Leo X, in his bull, which I ſhall quote afterwards, mentions that pope as the firſt who confirmed an eſtabliſhment of this kind. As the above account did not appear to me ſatisfactory, and as I knew before that the oldeſt lending-houſes in Italy were under the inſpection of the Franciſcans, I conſulted the Annals of the Seraphic Order, with full expectation that this ſervice would not be omitted in that work; and I indeed found in it more materials towards the hiſtory of lending-houſes than has ever been collected, as far as I know, by any other perſon.

As complaints againſt uſury, which was practiſed by many Chriſtians, but particularly by the Jews, became louder and more public in Italy in the fifteenth century, Barnabas Interamnenſis, probably of Terni, firſt conceived the idea of eſtabliſhing a lending-houſe. This man was originally a phyſician; had been admitted to the degree of doctor; was held in great reſpect on account of his learning; became a Minorite, or Franciſcan; acquired in that ſituation every rank of honour, and died, in the firſt monaſtery of this order at Aſſiſi *(in monte Subaſio)* *, in the year 1474.

* Of this Barnabas I know nothing more than what I have here extracted from *Waddingii Annales Minorum*, tom. xiv. p. 93. Wadding refers to *Marian.* lib. v. c. 40, § 17; and *Marc.* 3. p. lib. v. cap. 58. The former is *Marianus Florentinus*, whoſe *Faſciculus*

1474. While he was employed in preaching under Pope Pius II at Perugia, in the territories of the Church, and obſerved how much the poor were oppreſſed by the uſurious dealings of the Jews, he made a propoſal for raiſing a capital by collections, in order to lend from it on pledges to the indigent, who ſhould give monthly, for the uſe of the money borrowed, as much intereſt as might be neceſſary to pay the ſervants employed in this eſtabliſhment, and to ſupport it. Fortunatus de Copolis, an able juriſt of Perugia, who after the death of his wife became alſo a Franciſcan, approved of this plan, and offered to aſſiſt in putting it into execution. To be aſſured reſpecting an undertaking which ſeemed to approach ſo near to the lending on intereſt, both theſe perſons laid their plan before the univerſity of that place, and requeſted to know whether ſuch an eſtabliſhment could be allowed; and an anſwer being given in the affirmative, a conſiderable ſum was ſoon collected by preaching, ſo that there was a ſufficiency to open a lending-houſe. Notwithſtanding this

Faſciculus chronicorum Ordinis Minorum, which conſiſts of five books, was uſed in manuſcript by Wadding in compoſing his large work, and in my opinion has never been printed. *Marc.* is *Marcus Ulyſſiponenſis*, whoſe *Chronica Ordinis Minorum tribus partibus diſtincta* I have not been able to procure, though it is tranſlated into ſeveral languages. See *Waddingii Scriptores Ordinis Minorum.* Romæ 1650, fol. p. 248, 249. What is ſaid on this ſubject in *Argelati Bibliotheca Scriptor. Mediolanenſ.* Mediolani 1745, fol. i. p. 352, has been taken from Wadding.

ſanction, many were diſpleaſed with the deſign, and conſidered the receiving of intereſt, however ſmall it might be, as a ſpecies of uſury. Thoſe who exclaimed moſt againſt it were the Dominicans *(ex ordine Prædicatorum)*: and they ſeem to have continued to preach in oppoſition to it, till they were compelled by Leo X to be ſilent; while the Franciſcans, on the other hand, defended it, and endeavoured to make it be generally adopted. The diſpute became more violent when, at the end of a year, after all expences were paid, a conſiderable ſurplus was found remaining; and as the managers did not know how to diſpoſe of it, they at length thought proper to divide it amongſt the ſervants, becauſe no fixed ſalaries had been appointed for them. Such was the method firſt purſued at Perugia; but in other places the annual overplus was employed in a different manner. The particular year when this eſtabliſhment began to be formed I have no where found marked; but as it was in the time of Pius II, it muſt have been in 1464, or before that period *. It is

* This is confirmed by *M. B. Salon*, in t. ii. *Contr. de juſtit. et jure* in ii. 2 *Thom. Aquin.* qu. 88. art. 2. controv. 27: Hujus modi mons non erat in uſu apud antiquos. Cœpit fere a 150 annis, tempore Pii II. Hic enim pontifex eſt qui primus omnium legitur montem approbaſſe, cœpitque, Prædicatoribus hortantibus, reſpublicas et populos ad illum inſtituendum hortari, ne pauperes ab Hebræis acceptis conſumerentur. The Dominicans, or *Prædicatores*, however, oppoſed it. The preciſe year when this

is very remarkable that this pontiff confirmed the lending-houſe at Orvieto *(Urbs Vetus)* ſo early as the above year; whereas that at Perugia was ſanctioned, for the firſt time, by Pope Paul II in 1467*. It is ſingular alſo that Leo X, in his confirmation of this eſtabliſhment, mentions Paul II, Sixtus IV, Innocent VIII, Alexander VI, and Julius II; but not Pius II. Pope Sixtus IV, as Wadding ſays, confirmed in 1472 the lending-houſe at Viterbo, which had, however, been begun ſo early as 1469, by Franciſcus de Viterbo, a Minorite †.

In the year 1479, Sixtus IV confirmed the

inſtitution was formed may, perhaps, be mentioned in the particular hiſtory of the city of Perugia; but the *Storia di Perugia* by Pompeo Pellini I have not been able to ſearch; and in *Perugia auguſta deſcritta da Ceſare Criſpolti*, in Perugia 1648, 4to. p. 182, I find only: Monte detto della pietà, inſtituto di un venerabile padre dell'ordine Oſſervante, chiamato Fra Giacomo da monte Feltro; - - - fa di lui mentione il Gonzaga. Gonzaga, notwithſtanding the above account, aſcribes this ſervice not to any Jacob, but to the well-known Bernardino de Feltro. *De origine ſeraphicæ religionis Franciſcanæ.* Romæ 1587, fol. p. 338. In C. L. Richard's *Analyſis conciliorum generalium et particularium*, Venetiis 1776, 4 vol. fol. iv. p. 98, I find that the firſt lending-houſe at Perugia was eſtabliſhed in the year 1450; but Pius II, under whoſe pontificate it appears by various teſtimonies to have been founded, was not choſen Pope till the year 1458.

* Wadding, xiv. p. 94.

† Buſſi, Iſtoria della città di Viterbo. In Roma 1742, fol. p. 271.

lending-

lending-houſe which had been eſtabliſhed at Savona, the place of his birth, upon the ſame plan as that at Perugia. The bull iſſued for this purpoſe is the firſt pontifical confirmation ever printed *; for that obtained for Perugia was not, as we are told by the editor, to be found in the archives there in 1618, the time when the other was printed. I have never found the confirmation of thoſe at Orvieto and Viterbo. Aſcianus ſought for them, but without ſucceſs, in *Bullarium magnum Cherubini*, and they are not mentioned by Sixtus. This pontiff, in his bull, laments that the great expences to which he was ſubjected did not permit him to relieve his countrymen with money, but that

* It may be found in *Bolle et privilegi del ſacro monte della pietà di Roma.* In Roma 1618: riſtampati l'anno 1658. This collection is commonly bound up with the following work, which was printed in the ſame year and again reprinted: *Statuti del ſacro monte della pietà di Roma.* This bull is inſerted entire by Aſcianus, p. 719: but in the Collection of the pontifical bulls it is omitted. I ſhall here give only the following extracts from it. Ut hujuſmodi incommodis *(the uſurious practices of the Jews)* obvient, cupiunt, ad inſtar dilectorum filiorum civium civitatis noſtræ Peruſinæ, in prædicta civitate Savonenſi, ex piis Chriſti fidelium ſuffragiis, ac alias colligere, et in unam maſſam, quæ mons pietatis nuncupetur, redigere aliquam non parvæ pecuniæ ſummam, de qua perſonis pauperibus et egenis, per officiales, examinata cauſſa neceſſitatis eorum, ac receptis pignoribus ab eiſdem, opportune valeat proportionabiliter ſubveniri eo modo, quo ſubvenitur ex pecuniis montis pietatis in Peruſina civitate dudum apoſtolica auctoritate interveniente ordinati, dummodo eis deſuper per nos licentia concedatur.

he would grant to the lending-houſe ſo many ſpiritual advantages as ſhould induce the faithful to contribute towards its ſupport; and that it was his deſire that money ſhould be lent from it to thoſe who would aſſiſt gratis during a year in the buſineſs which it required. If none could be found to ſerve on theſe conditions, a moderate ſalary was to be given. He added a clauſe alſo reſpecting pledges; but paſſed over in ſilence that the debtors were to contribute any thing for the ſupport of the inſtitution by paying intereſt, which Barnabas, whoſe name does not occur in the bull, introduced however at Perugia, and which the Pope tacitly approved.

The greater part of the lending-houſes in Italy were eſtabliſhed in the fifteenth and following centuries by the Minorites Marcus Bononienſis, Michael a Carcano *, Cherubinus Spoletanus, Jacobus de Marchia, Antonius Vercellenſis, Angelus a Clavaſio, and, above all, Bernardinus Tomitano, named alſo *Feltrenſis* and *Parvulus*. This man was born at Feltri, in the county of Treviſo, in the year 1439. His father was called Donato Tomitano, and his mother Corona Rambaldoni; they were both of diſtinguiſhed families, though ſome aſſert that he was of low extraction, and a native of Tomi, a ſmall

* This Michael travelled and preached much in company with Bernardinus, and died at Como in 1485. *Wadding*, xiv. p. 396.

place

place near Feltri, on which account he got the name of Tomitano. The name of *Parvulus* arose from his diminutive stature, which he sometimes made a subject of pleasantry *. This much at any rate is certain, that he had received a good education. In 1456, when seventeen years of age, he suffered his instructors, contrary to the inclination of his father, to carry him to Padua, to be entered in the order of the Minorites; and on this occasion he changed his christian-name Martin into Bernardinus †. As he was a good speaker, he was employed by his Order in travelling through Italy and preaching. He was heard with applause, and in many parts the people almost paid him divine honours. The chief object of his sermons was to banish gaming, intemperance, and extravagance of dress; but he, above all, attacked the Jews, and excited such a hatred against them, that the governments in many places were obliged to entreat or to compel him either to quit their territories or not to preach in opposition to these unfortunate people, whom the crowds he collected threatened to massacre; and sometimes when he visited cities,

* The Piccolimini, nephews of the Pope, having once paid their respects to him at Siena, he told them he was their namesake. *Wadding*, xiv. p. 447.

† Wadding, xii. p. 442. In *Lettere dell'agricoltura, dell'arti e del commercio*, by Anton. Zanon, vol. vi. p. 149, the year 1459 is given, which perhaps is an error of the press.

where

where there were rich Jews, and perſons who were connected with them in trade, he was in danger of loſing even his own life. Taking advantage of this general antipathy to the Jews, he exerted himſelf, after the example of Barnabas, his brother Minorite, to get lending-houſes eſtabliſhed, and died at Pavia in the year 1494. The Minorites played a number of juggling tricks with his body, pretending that it performed miracles, by which means they procured him a place in the catalogue of the ſaints; and to render his name ſtill more laſting, ſome of his ſermons have been printed among the works of the Franciſcan order *.

The lending-houſes in Italy, with the origin of which I am acquainted, are as follows: The lending-houſe at Perugia was inſpected in 1485, by Bernardinus, who enlarged its capital.

The ſame year he eſtabliſhed one at Aſſiſi, which was confirmed by pope Innocent, and which was viſited and improved by its founder in 1487 †.

In the year 1486, after much oppoſition, he eſtabliſhed a lending-houſe at Mantua, and pro-

* Waddingii Scriptores ordinis Minorum, p. 58. *Fabricii Biblioth. mediæ et infimæ æt.* i. p. 586.

† Wadding, xiv. p. 398 and 433.

cured

cured for it alſo the Pope's ſanction *. Four years after, however, it had declined ſo much, that he was

* It may be found entire in *Wadding*, xiv. p. 411. It was ordered that the pledges ſhould be worth double the ſum lent, and that they ſhould be ſold if not redeemed within a year. The regulations made reſpecting the intereſt I ſhall here inſert: Liceretque eis pro hujuſmodi ſalariorum ſolutione, ac etiam penſione domus ad præmiſſa in loco commodo et honeſto conducenda in civitate prædicta, libris et ſubhaſtationibus, aliiſque expenſis neceſſariis pro executione eis commiſſorum officiorum hujuſmodi, a perſonis mutuo recipientibus pecunias dicti montis, illaſque reſtituentibus intra annum, præter ſummam mutuatam, duos denarios pro qualibet libra mutuata ejus ſummæ, pro quolibet menſe petere et recuperare, et a non reſtituentibus de pretio venditorum pro tempore pignorum retinere; et ſi dicti duodenarii pro libra ſic collecti, in fine anni non aſcenderent ad ſummam opportunam pro ſalariis et aliis expenſis prædictis, voluerunt id quod deficeret, ſuppleri de ſumma anni ſequentis; et ſi ſumma dictorum duorum denariorum pro libra ſic collecta, in fine anni tranſcenderet ſummam opportunam pro ſalariis et expenſis prædictis, voluerunt id quod ſuperabundaret, eiſdem ſolventibus proportionabiliter et pro rata, pro qua ſolviſſent, ultra reſtitui, ſi recuperare vellent, et ad hunc effectum publice ſæpius proclamari per civitatem prædictam, quod quicunque intenderent rehabere portiones eis contingentes, de ſuperabundantia prædicta collecta per exactorem duorum denariorum pro libra, debeant proteſtari officialibus prædictis infra quindecim dies ad minus a die ſibi facti mutui, recepiſſe mutuo animo rehabendi talem portionem eis contingentem, quantumcumque parvam; alioquin, decurſis dictis quindecim diebus, proteſtatione prædicta non facta, intelligerentur, poſt tot proclamationes repetitis vicibus factas, tales mutuo recipientes, et non proteſtantes, velle, immo mandare ac injungere dictis

was obliged to preach in order to procure new donations to ſupport it *.

At Florence he met with ſtill more oppoſition; for the rich Jews bribed the members of the government, who wiſhed, in appearance, to favour the eſtabliſhment of the lending-houſe, to which they had conſented eighteen years before, while they ſecretly thwarted it; and ſome boys having once proceeded, after hearing a ſermon, to attack the houſes of the Jews, the Minorites were ordered to abſtain from preaching and to quit the city †. It was, however, completely eſtabliſhed; but by the Dominican Hieronymus Savonarola ‡.

In the year 1488, Bernardinus eſtabliſhed a lending-houſe at Parma, and procured for it the Pope's ſanction ||, as well as for one at Ceſena, where

dictis officialibus, quod diſpenſent pauperibus, vel convertant in alias pias cauſas, illas parvas quantitates et portiones, quæ ipſos proteſtantes contigebant de dicta quantitate ſuperabundanti, amore Dei, et pro ſuæ ac ſuorum prædeceſſorum animarum ſalute, de conſilio duorum religioſorum, vel aliorum ſacerdotum, aut aliorum bonæ opinionis et famæ.

* Wadding, xiv. p. 516.

† Ibid. p. 446.

‡ Oſſervazioni di D. Manni circa i ſigilli antichi, tom. xxvii. p. 92; where much information reſpecting this ſubject may be found.

|| Wadding, xiv. p. 445. *La hiſtoria della città di Parma, di Bonaventura Angeli.* In Parma 1591, 4to. p. 429.

the

the intereſt was defined to be *pro ſalariis officialium et aliis montis oneribus perferendis* *. About the concluſion of this year, he was at the other end of Italy, where he re-eſtabliſhed the lending-houſe at Aquila in the kingdom of Naples †.

In the year following he eſtabliſhed one at Chieti *(Theate)* in the ſame kingdom, another at Rieti *(Reate)* in the territories of the Church, a third at Narni *(Narnia)* ‡; and a fourth at Lucca, which was confirmed by the biſhop, notwithſtanding the oppoſition of the Jews, who did every thing in their power to prevent it.

In the year 1490, a lending-houſe was eſtabliſhed at Piacenza *(Placentia)* by Bernardinus, who at the ſame time found one at Genoa, which had been eſtabliſhed by the before-mentioned Angelus à Clavaſio ||. At this period alſo, a lending-houſe was eſtabliſhed at Verona §, and another at Milan by the Minorite Michael de Aquis ¶.

* This bull of Innocent VIII may be found in the before-quoted *Bolle et privilegi del ſacro monte della pietà di Roma*, p. 10.

† Wadding, xiv. p. 451.

‡ Wadding, xiv. p. 462. Ibid. 465.

|| Ibid. 480, 481.

§ Wadding, xiv. p. 517. *Cronica di Verona, deſcritta da Pier. Zagata.* In Verona 1747, 4to. ii. 1. p. 202, and ii. 2. p. 88.

¶ Il Ritrato di Milano, di Carlo Torre. In Milano 1714, 4to. p. 229.

In

In 1491, a lending-houſe was eſtabliſhed at Padua, which was confirmed by pope Alexander VI, in 1493 *; and another was eſtabliſhed at Ravenna †.

In 1492, Bernardinus reformed the lending-houſe at Vicenza, where, in order to avoid the reproach of uſury, the artifice was employed of not demanding any intereſt, but admoniſhing the borrowers that they ſhould give a remuneration according to their piety and ability. As people were by theſe means induced to pay more intereſt than what was legally required at other lending-houſes, Bernardinus cauſed this method to be aboliſhed ‡. He eſtabliſhed a lending-houſe alſo the ſame year in the ſmall town of Campo S. Pietro, not far from Padua, and expelled the Jews who had lent upon pledges. At this period there were lending-houſes at Baſſano, a village in the county of Treviſi, and alſo at Feltri, which he inſpected and improved ||.

* Wadding, xiv. p. 93, 482. *Merula Coſmograph.* p. ii. lib. iv. p. m. 950. The confirmation is given by Zanon, *lettere* vi. p. 152.

† Wadding, p. 514. *Hieron. Rubei Hiſtoriæ Ravennates.* Ven. 1590. fol. lib. vii. *Il foreſtiere inſtruito della coſe notabili della città di Ravenna; di Franc. Beltrami.* In Ravenna 1783, 8vo. p. 119.

‡ Wadding, xv. p. 6, 65.

|| Wadding, xv. p. 7, 12, 9.

In the year 1493, Bernardinus cauſed a lending-houſe to be eſtabliſhed at Crema, in the Venetian dominions; another at Pavia, where he requeſted the opinion of the juriſts, whom he was happy to find favourable to his deſign; and likewiſe a third at Gubbio, in the territories of the Church. At the ſame time another Franciſcan eſtabliſhed at Cremona a *mons frumenti pietatis*, from which corn was lent out on intereſt to neceſſitous perſons; and it appears that there had been an inſtitution of the like kind before at Parma *.

In the year 1494, Bernardinus, a ſhort time before his death, aſſiſted to eſtabliſh a lending-houſe at Montagnana, in the Venetian territories †, and to improve that at Breſcia, which was likely to decay, becauſe the ſervants had not fixed ſalaries ‡.

* Wadding, xv. p. 37, 45, 46.

† Wadding, xv. 67.

‡ Wadding, xv. p. 68. Bernardinus conſidered the giving of wages as a neceſſary evil. Speciosius et religioſius fatebatur Bernardinus fore, ſi abſque ullo penitus obolo et pretio mutuum daretur, libereque commodaretur pecunia, ſed pium opus et pauperum ſubſidium exiguo ſic duraturum tempore; non enim, inquit, tantus eſt ardor hominum, ut gubernatores et officiales montium miniſterio neceſſarii velint laborem hunc omnem gratis ſubire; quod ſi remunerandi ſint ex ſorte principali, vel ipſo depoſito, ſeu exili montium ærario, brevi exhaurietur, et commodum opportunumque iſtud pauperum refugium ubique peribit. *Wadding*, xv. p. 41.

The

The ſame year another Franciſcan eſtabliſhed the lending-houſe at Modena *.

In the year 1506, pope Julius II confirmed the lending houſe at Bologna †. That of Trivigi was eſtabliſhed in 1509 ‡; and in 1512, Elizabeth of the family of Gonzaga, as widow of duke Guido Ubaldus, eſtabliſhed the firſt lending-houſe in the duchy of Urbino at Gubbio, and procured permiſſion for it to coin money ||.

The hiſtorical account I have here given, diſplays in the ſtrongeſt light the great force of prejudice, and particularly of the prejudice of eccleſiaſtics. Notwithſtanding the manifeſt advantages with which lending-houſes were attended, and though a great part of them had been already ſanctioned by the infallible court of Rome, many, but chiefly Dominicans, exclaimed againſt theſe inſtitutions, which they did not call *montes pietatis*,

* Wadding, xv. p. 88.

† The bull may be found in *Bolle e privilegi del ſacro monte della pietà di Roma*, before quoted, p. 13; and in Aſcianus, p. 775.

‡ Iſtoria di Trivigi; di Giovanni Bonifaccio. In Venezia 1744, fol. p. 501.

|| Della zecca di Gubbio, e delle geſte de' conti e duchi di Urbino; opera di Rinaldo Repoſati. In Bologna 1772, 4to. ii. p. 96. 132.

but *impietatis*. No oppoſition gave the Minorites ſo much uneaſineſs as that of the Dominican Thomas de Vio, who afterwards became celebrated as a cardinal under the name of Cajetanus. This monk, while he taught at Pavia, in 1498, wrote a treatiſe *De monte pietatis* *, in which he inveighed bitterly againſt taking pledges and intereſt, even though the latter was deſtined for the maintenance of the ſervants. The popes, he ſaid, had confirmed lending-houſes in general, but not every regulation that might be introduced into them, and had only given their expreſs approbation of them ſo far as they were conſiſtent with the laws of the church. Theſe words, he added, had been wickedly left out in the bulls which had been printed; but he had heard them, and read them, in the confirmation of the lending-houſe at Mantua †. I indeed

* It is to be found in the well-known large collection of juridical writings quoted commonly under the title: *Tractatus tractatuum*. Venetiis 1584, fol. p. 419, vol. vi. part 1. It has alſo been printed ſeparately.

† Nota quod mons ipſe eſt ſimpliciter approbatus et erectus ab ipſo Summo Pontifice. Ejus autem capitula ſupradicta ſunt approbata cum hoc adjectivo, ſcilicet: ſacris canonibus non contraria. Unde, ſi qua capitula ſunt ſacris canonibus contraria, approbata non ſunt. Hæc autem eſſe ea quæ injuſtitiam continent, nullus dubitat. Non ſunt igitur approbata capitula illa, quæ injuſta eſſe ſuperius monſtratum eſt. Propter quod (ſi ita eſt) non parum peccatum fuit facere imprimi Summi Pontificis bullas truncatas abſque illa particula, ſcilicet, ſacris canonibus non contraria. Laqueus ſiquidem eſt animarum, in quem ego incidiſſem, vel ſal-

deed find, that theſe words are not in the copy of that bull given in Wadding, which is ſaid to have been taken from the original, nor in the ſtill older confirmation of the lending-houſe at Savona. But even were they to be found there, this would not juſtify Cajetan's oppoſition, as the Pope in both theſe bulls recommended the plan of the lending-houſe at Perugia to be adopted, of which receiving intereſt formed a part. Bernardinus de Buſtis *, a Minorite, took up the cauſe in oppoſition to Cajetan, and, according to Wadding's account, with rather too much vehemence. Among his antagoniſts alſo were Barrianus, and Franc. Papafava, a juriſt of Padua †. As this diſpute was revived with a great deal of warmth in the beginning of the ſixteenth century, it was at length terminated by pope Leo X, who in the tenth ſitting of the coun-

tem abſque ſuſpenſione non fuiſſem, niſi viva voce audiſſem ſic habere in originalibus, et calamo ſcriptam particulam illam in bullæ Mantuanæ copia vidiſſem. Ex hac quoque eadem radice ſatisfit illis qui ex privilegiis et indulgentiis conceſſis a Rom. Pont. illis qui ad montis conſervationem aut augmentum manus porrigunt adjutrices arguunt. Jam enim patet, quod mons ipſe ſanctus eſt, et in ordine ad illum hæc omnia conceduntur. Annexa tamen mala ex hoc non approbantur, ſed potius tolerantur ad evitationem majoris mali, quo per publicos uſuarios res pauperum vorantur.

* His works were printed together, in folio, at Breſcia in 1588.

† The work of the former appeared in 1496. The writings of both are printed in the work of Aſcianus, or Zimmermann, which has been often quoted already.

cil of the Lateran declared by a particular bull, that lending-houſes were legal and uſeful; that all doubts to the contrary were ſinful, and that thoſe who ſhould write againſt them would be in a ſtate of excommunication *. The whole aſſembly, except one archbiſhop, voted in favour of this determination †; and it appears from a decree of the council of Trent, that it alſo acknowledged their legality, and confirmed them ‡. Notwithſtanding this deciſion, there were ſtill writers who ſometimes

* This bull, which forms an epoch in the hiſtory of lending-houſes, may be found in *Sa. Lateranen. concilium noviſſimum.* Romæ 1521, fol. This ſcarce work, which I have now before me from the library of our univerſity, is inſerted entire in *(Harduini) Acta conciliorum*, tom. ix. Pariſiis 1714, fol. The bull may be found p. 1773. It may be found alſo in *Bullarium mag. Cherubini*, i. p. 560; *Waddingii Annal. Minor.* xv. p. 470; *Aſcianus*, p. 738; and *Beyerlinck's Theatrum vitæ hum.* v. p. 603. The Pope, in the bull, refers to Juriſprudence, which ſays: quod qui commodum ſentit, onus quoque ſentire debeat. - - - *He then permits:* alios etiam ſimiles montes cum apoſtolicæ ſedis approbatione erigi poſſe - - - Omnes qui contra hancce declarationem prædicare ſeu diſputare et ſcribere auſi fuerint, excommunicationis latæ ſententiæ pœnam incurrere volumus.

† Reſponderunt omnes placere, excepto reverendo patre domino Jeremia archiepiſcopo Tranenſi, qui dixit, non placere, quia didicit per experientiam, quod præfati montes ſunt plus damnoſi quam utiles. *Theſe words ſtand in the protocoll.*

‡ This is the concluſion formed by Richard, in *Analyſis conciliorum*, becauſe in ſeſſ. 22. cap. 8, lending houſes are reckoned among the *pia loca*, and the inſpection of them aſſigned to the biſhops.

condemned

condemned them; and who did not conſider all the decrees, at leaſt the above one, of the Lateran council as agreeable to juſtice. Among theſe was Dominicus de Soto, a Dominican *. All oppoſition, however, in the courſe of time ſubſided, and in the year 1565, Charles Borromeo, the pope's legate at the council of Milan, ordered all governments and eccleſiaſtics to aſſiſt in eſtabliſhing lending-houſes †.

Of the lending-houſes eſtabliſhed after this period in Italy, I ſhall mention thoſe only of Rome and Naples. It is very remarkable that the Pope's capital ſhould have been without an inſtitution of this kind till the year 1539, and that it ſhould have been formed by the exertions of Giovanni Calvo, a Franciſcan ‡. Paul III, in his bull of confirmation, ordered that Calvo's ſucceſſors in rank and employment ſhould always have the inſpection of it, becauſe the Franciſcans had taken the greateſt pains to endeavour to root out uſury ||.

The lending-houſe at Naples was firſt eſtabliſh-

* In Libri x. de injuſtitia et jure. vi. quæſt. 1 & 6.

† Waddingii Annal. Minor. xv. p. 471.

‡ Commiſſario generale dell' Ordine Minore de' conventuali di S. Franciſco.

|| This confirmation may be found in Waddingii Annal. xvi. p. 444, and in Aſcianus, p. 766.

ed in 1539 or 1540. Two rich citizens, Aurelio Paparo, and Leonardo or Nardo di Palma, redeemed all the pledges which were at that time in the hands of the Jews, and offered to deliver them to the owners without intereſt, provided they would return the money which had been advanced on them. More opulent perſons ſoon followed their example; many bequeathed large ſums for this benevolent purpoſe; and Toledo, the viceroy, who drove the Jews from the kingdom, ſupported it by every method poſſible. This lending-houſe, which has indeed undergone many variations, is the largeſt in Europe; and it contains ſuch an immenſe number of different articles, many of them exceedingly valuable, that it may be conſidered as a repoſitory of the moſt important part of the moveables of the whole nation. About the year 1563, another eſtabliſhment of the like kind was formed under the title of *banco de' poveri*. At firſt this bank advanced money without intereſt, only to relieve confined debtors; afterwards, as its capital increaſed, it lent upon pledges, but not above the ſum of five ducats without intereſt. For larger ſums the uſual intereſt is demanded *.

* (Summonte) Hiſtoria della città e regno di Napoli; in Napoli 1749, 4to. vol. iv. p. 179. *Giannone, Geſchichte des königreichs Neapel; mit anmerkungen von Le Bret*; Leipzig 1770, 4to. vol. iv. p. 95. *De' banchi di Napoli, e della lor ragione; trattato di Michele Rocco*, Neapoli 1785, 3 vol. 8vo. i. p. 151.

At

At what time the firſt lending-houſe was eſtabliſhed at Venice I have not been able to learn *. This State ſeems to have long tolerated the Jews; it endeavoured to moderate the hatred which had been conceived againſt them, and gave orders to Bernardinus to forbid preaching againſt them †. It appears to me in general, that the principal commercial cities of Italy were the lateſt to avail themſelves of this invention; becauſe they knew that to regulate intereſt by law, where trade was flouriſhing, would be ineffectual or uſeleſs; or becauſe the rich Jew merchants found means to prevent it.

The name *mons pietatis*, of which no ſatisfactory explanation has been as yet given, came with the invention from Italy, and is equally old, if not older. Funds of money formed by the contributions of different perſons, for ſome end ſpecified, were long before called *montes*. In the firſt century of the Chriſtian æra, free gifts were collected and preſerved in churches by eccleſiaſtics, partly for the purpoſe of defraying the expence of divine ſervice, and partly to relieve the poor. Such capitals, which were conſidered as eccleſiaſtical funds,

* Vettor Sandi, in *Principi di ſtoria civile della republica di Venezia*. In Venezia 1771, 4to. vol. ii. p. 436. The author treats expreſsly of the inſtitution of this bank, but the year when it commenced is not mentioned.

† Waddingii Annal. Minor. xv. p. 67.

were

were by rudentius, in the beginning of the fifth century, called *montes annonæ*, and *arca numinis* *. Tertullian calls them *depoſita pietatis* †; and

* Hymnus ii. in honorem Laurentii. The poet relates, that, in the third century, the pagan governor of the city *(præfectus urbis)* demanded the church treaſure from Laurentius the deacon. Ver. 53:

Laurentium iſti jubet;
Exquirit arcam ditibus
Maſſis refertam, et fulgidæ
Montes monetæ conditos.

This paſſage, as far as I know, was firſt remarked by H. C. Senkenberg in a poſtſcript to L. J. Meyer's *Diſſertat. de montibus pietatis*; Giſſæ 1739, 4to. p. 51. He is of opinion that the expreſſion *mons pietatis* was uſual even at that period, becauſe the following lines occur, ver. 81,

Hæc occultantur abditis
Eccleſiarum in anguſis;
Et ſumma pietas creditur,
Nudare dulces liberos.

To ſpeak the truth, *pietas* in this paſſage does not refer to *mons*. The Chriſtians are here reproached in an ironical manner with their parental affection, *pietas*; becauſe they impoveriſhed their children and grandchildren to enrich the church. That the money collected in this manner, however, was not employed merely for ornamenting churches, but diſtributed alſo in alms, is well known, and is proved even by what Prudentius ſays, ver. 140. See *Salmaſius de fœn. trapezit.* p. 421, and the preface.

† This paſſage, with which Senkenberg was not acquainted, may be found in Tertullian's *Apolog.* cap. 39, edition of De la Cerda, p. 187: Hæc quaſi depoſita pietatis ſunt; nam inde non epulis, non potiunculis, nec ingratis voratrinis diſpenſatur; ſed egenis

and hence has been formed *montes pietatis*. At any rate I am of opinion that the inventor chose and adopted this name in order to give his institution a sacred or religious appearance, and to procure it more approbation and support.

I find however that those banks employed in Italy, during the thirteenth and fourteenth centuries, to borrow money in the name of States, for which the public revenues were mortgaged and interest paid, were also called *montes* *. In this sense the

egenis alendis humandisque, et pueris ac puellis re ac parentibus destitutis, jamque domesticis senibus, item naufragis, et si qui in metallis, et si qui in insulis, vel in custodiis, duntaxat ex caussa Dei sectæ, alumni confessionis suæ fiunt.

* This word however is not to be found in *Glossarium manuale*. The following passage from *Leonardi Arctini Histor. Florentinarum libri* xii. Argentorati 1610. fol. lib. vii. p. 145, may serve as a proof. Eodem anno maximum est reipublicæ fundamentum parvo ex principio jaci cœptum. Civibus resp. debebat auripondo circiter LXX.M. dudum mutuo sumta ob Lucæ redemtionem. Ea igitur summa cum ob angustiam ærarii dissolvi non posset, ac iniquum videretur suo fraudari cives, qui fidem publicam secuti mutuo dederant; media quædam inter has difficultates reperta est via. Nominibus enim eorum, quibus debebatur, tributim descriptis annui reditus e publico constituti sunt, quina singulis centenis. Quantitates vero ipsas in unum coacervatas, a similitudine cumulandi, vulgo Montem vocavere. Idque in civitate postea servatum. Quoties resp. indiget, cives tributa persolvunt; solutorum vero pensiones annuas percipiunt. Hi montes cumulationesque pecuniarum bellis quidem crescunt, pace minuuntur, propterea

the word is uſed by Italian hiſtorians of much later times; and thoſe are greatly miſtaken, who, with Aſcian and many others, conſider all theſe *montes* as real lending-houſes. Theſe loan-banks, or *montes*, received various names, ſometimes from the princes who eſtabliſhed them, ſometimes from the uſe to which the money borrowed was applied, and ſometimes from the objects which were mortgaged. Of this kind were the *mons fidei*, or loan opened by pope Clement VII, in the year 1526, for defending his capital *; the *mons aluminarius*, under pope Pius IV, for which the pontifical alum-works were pledged; the *mons religionis*, under Pius V, for carrying on the war againſt the Turks; and the *montes farinæ*, *carnium*, *vini*, &c. when the duties upon theſe articles were pledged as a ſecurity. To facilitate theſe loans, every condition that could induce people to advance money was thought of. Sometimes high intereſt was given, if the ſubſcribers

propterea quod abundante rep. diſſolutio fit crebra atque peremtio. Quantitatum vero deſcriptarum et venditio eſt civibus inter ſe et permutatio, atque (ut in cæteris mercimoniis) pro tempore, pro ope, pro commodo, minuitur earum precium atque augeſcit. In emtorem eadem commoda, quæ ſolutus ipſe percepturus erat, transferuntur. Ea res facit, uti cives ad crebras tributorum ſolutiones perdurent, non pereunte omnino quod ſolutum eſt; ſed utilitatem, ſi non magnam attamen aliquam, afferente.—Compare Le Bret in *Allgem. Welthiſtorie*, xlv. p. 10, who however relates ſome circumſtances not to be found in Aretin.

* See the bull in Bullarium mag. Cherub. n. 17.

agreed

agreed that it ſhould ceaſe, and the capital fall to the bank, after their death; and ſometimes low intereſt was given, but the ſecurity was heritable and could be transferred at pleaſure. The former were called *montes vacabiles*, and the latter *montes non vacabiles*. Sometimes the State engaged to pay back the capital at the end of a certain period, ſuch for example as nine years, as was the caſe in regard to the *mons novennalis*, under Paul IV; or it reſerved to itſelf the option of returning the money at ſuch a period as it might think proper, and ſometimes the capital was ſunk and the intereſt made perpetual. The firſt kind were called *montes redimibiles*, and the ſecond *irredimibiles* *. One can here clearly diſcover the origin of life-rents, annuities, tontines, and government ſecurities; but the farther illuſtration of this ſubject I ſhall leave to thoſe who may wiſh to employ their talents on a hiſtory of national debts. I have introduced theſe remarks merely to rectify a miſtake which has become almoſt general, and which occaſioned ſome difficulties to me in this reſearch; and I ſhall only obſerve farther, that the popes gave to their loans, in order to raiſe their ſinking credit, many of thoſe ſpiritual advantages which they conferred on the *montes pietatis*. This error therefore was more eaſily propagated, as both were called *montes*; and hence

* See Petr. Gregorius Tholoſanus de republica. Francof. 1609, 4to. lib. xiii. c. 16. p. 566; and Aſcianus, p. 753.

it

it has happened that Aſcianus and others aſſert that many lending-houſes were miſapplied by the popes in order to raiſe public loans.

From the inſtances here adduced, one may ſee that the firſt lending-houſes were ſanctioned by the pontiffs, becauſe they only could determine to the Catholics in what caſes it was lawful for them to receive intereſt. This circumſtance ſeems to have rendered the eſtabliſhment of them without Italy difficult. At any rate the Proteſtants were at firſt averſe to imitate an inſtitution which originated at the court of Rome, and which, according to the prevailing prejudice of the times, it alone could approve; and from the ſame conſideration they would not adopt the reformation which had been made in the calendar.

The firſt mention of a lending-houſe in Germany, which I have as yet met with, is to be found in the permiſſion granted by the emperor Maximilian I, to the citizens of Nuremberg, in the year 1498, to drive the Jews from the city, and to eſtabliſh an exchange-bank. The permiſſion farther ſtated, "That they ſhould provide "for their bank proper managers, clerks, and "other perſons to conduct it according to their "pleaſure, or as neceſſity might require; that ſuch "of their fellow-citizens as were not able to carry "on their trades, callings, and occupations with-

"out

" out borrowing, and without pledging their ef-
" fects, ſhould, on demand, according to their
" trade and circumſtances, receive money, for
" which pledges, caution and ſecurity ſhould be
" taken; that at the time of payment a certain
" ſum ſhould be exacted by way of intereſt; that
" the clerks and conductors of the bank ſhould
" receive ſalaries for their ſervice from the intereſt;
" and that if any ſurplus remained, it ſhould be
" employed for the common uſe of the city of Nu-
" remberg, like any other public fund *."

It here appears that the lending-houſes in Germany were firſt known under the name of exchange-banks, by which was before underſtood any bank where money was lent and exchanged; but it does not thence follow, as profeſſor Fiſcher thinks †, that they were an Italian invention. The citizens of Nuremberg had not then a lending-houſe, nor was one eſtabliſhed there till the year 1618. At that period they procured from Italy copies of the regulations drawn up for various houſes of this kind, in order to ſelect the beſt. Thoſe of the city of Augſburg however were the grounds on which they built, and they ſent thither

* This permiſſion may be found at the end of A. Wurfel's *Hiſtoriſchen nachrichten von der ehemaligen Juden-Gemeinde in Nürnberg*. Nürnberg 1775, 4to. p. 152.

† Geſchichte des Teutſchen handels, ii. p. 454.

the perſons choſen to manage their lending-houſe, that they might make themſelves fully acquainted with the nature of the eſtabliſhment at that place *. In the year 1591, the magiſtrates of Augſburg had prohibited the Jews to lend money, or to take pledges; at the ſame time they granted 30,000 florins as a fund to eſtabliſh a lending-houſe, and the regulations of it were publiſhed in 1607 †.

In the Netherlands, France, and England, lending-houſes were firſt known under the name of *Lombards*, the origin of which is evident. It is well known that in the thirteenth and following centuries many opulent merchants of Italy, which at thoſe periods was almoſt the only part of Europe that carried on an extenſive trade, were invited to theſe countries, where there were few mercantile people able to engage deeply in commerce. For this reaſon they were favoured by governments in moſt of the large cities; but in the courſe of time they became objects of univerſal hatred, becauſe they exerciſed the moſt oppreſſive uſury, by lending at intereſt and on pledges. They were called *Longobardi* or *Lombardi*, as whole nations are often

* Gokinks Journal von und für Teutſchland, 1784, i. p. 504, where may be found the firſt and the neweſt regulations reſpecting the lending-houſe at Nuremberg.

† P. von Stettens Geſchichte der ſtadt Augſburg. Frank. und Leipzig 1743, 2 vol. 4to. i. p. 720, 789, 833.

named

named after a part of their country, in the ſame manner as all the Helvetians are called Swiſs, and the Ruſſians ſometimes Moſcovites. They were, however, called frequently alſo Caorcini, Caturcini, Caurſini, Cawarſini, Cawartini, Bardi, and Amanati; names, which in all probability aroſe from ſome of their greateſt houſes or banks. We know, at any rate, that about thoſe periods the family of the Corſini were in great conſideration at Florence *. They had banks in the principal towns for lending money; they demanded exorbitant intereſt; and they received pledges at a low value, and retained them as their own property if not redeemed at the ſtated time. They eluded the prohibition of the church againſt intereſt when they found it neceſſary, by cauſing the intereſt to be previouſly paid as a preſent or premium; and it appears that ſome ſovereigns borrowed money from them on theſe conditions. In this manner did Edward III, king of England, when travelling through France, in the year 1329, receive 5000 marks from the bank of the Bardi, and give them in return, by way of acknowledgement, a bond for 7000 †. When complaints againſt the uſurious practices of theſe Chriſtian Jews became too loud to be diſregarded, they were threatened with expulſion from the country, and thoſe who had ren-

* See theſe words in Du Freſne.

† Fœdera, vol. iv. p. 387.

dered themſelves moſt obnoxious on that account, were often baniſhed, ſo that thoſe who remained were obliged to conduct their employment with more prudence and moderation. It is probable that the commerce of theſe countries was then in too infant a ſtate to diſpenſe altogether with the aſſiſtance of theſe foreigners. In this manner were they treated by Louis IX, in 1268, and likewiſe by Philip the Bold; and ſometimes the popes, who would not authoriſe intereſt, lent their aſſiſtance by prohibitions, as was the caſe in regard to Henry III of England in 1240.

In the fourteenth century, the Lombards, in the Netherlands, paid to government rent for the houſes in which they carried on their money tranſactions, and ſomething beſides for a permiſſion. Of this we have inſtances at Delft in 1313, and at Dordrecht in 1342 *. As in the courſe of time the original Lombards became extinct, theſe houſes were let, with the ſame permiſſion, for the like employment †; but governments at length fixed the rate of intereſt which they ought to receive, and eſtabliſhed regulations for them, by which uſurious practices were reſtrained. Of leaſes granted

* Proofs may be found in *Beſchryving der Stadt Delft.* Te Delft 1729, fol. p. 553.

† Salmaſius de fœnore trapezitico. Lugduni Bat. 1640, 8vo. p. 744.

on

on ſuch conditions, an inſtance occurs at Delft in the year 1655. In 1578, William prince of Orange recommended to the magiſtrates of Amſterdam Francis Maſaſia, one of the Lombards, as they were then called, in order that he might obtain for him permiſſion to eſtabliſh a lending-houſe *; as many obtained permiſſion to keep billiard-tables, and Jews letters of protection. In the year 1611, the proprietor of ſuch a houſe at Amſterdam, who in the latter years of his leaſe had gained by his capital at leaſt thirty-three and a half per cent. offered a very large ſum for a renewal of his permiſſion; but, in 1614, the city reſolved to take the lombard or lending-houſe into their own hands, or to eſtabliſh one of the ſame kind. However deteſted this plan might be, a diſpute aroſe reſpecting the legality of it, which Marets † and Claude Saumaiſe endeavoured to ſupport. The public lending-houſe or lombard at Bruſſels was eſtabliſhed in 1619; that at Antwerp in 1620, and that at Ghent in 1622 ‡. All theſe were eſtabliſhed by the archduke Albert, when he entered on the governorſhip, with the advice of the archbiſhop of Mechlin; and on this

* De koophandel van Amſterdam. Te Rotterdam 1780, 8vo. I. p. 221.

† S. de Marets Diſſ. de trapezitis.

‡ Aſcianus, p. 773, taken from *David a Mauden Diſcurſus morales in decalogum*, p. 936.

occaſion the architect Wenceſlaus Coberger was employed, and appointed inſpector-general of all the lending-houſes in the Spaniſh Netherlands *. Some Italians aſſert, that the Flemings were the firſt people who borrowed money on intereſt for their lending-houſes; and they tell us that this practice began in the year 1619 †. We are aſſured alſo, that, after long deliberation at Bruſſels, it was at length reſolved to receive money on intereſt at the lending-houſes. It however appears certain, that in Italy this was never done, or at leaſt not done till a late period, and that the capitals of the lending-houſes there were amaſſed without giving intereſt.

This beneficial inſtitution was always oppoſed in France; chiefly, becauſe the doctors of the Sorbonne could not diveſt themſelves of the prejudice againſt intereſt: and ſome in modern times who undertook there to accommodate people with money on the like terms, were puniſhed by government ‡. A lending-houſe however was eſtabliſh-

* Beyerlinck, Magnum theatrum vitæ. Lugduni, fol. tom. v. p. 602.

† Montes e pecunia ad cenſum ſumta inſtituti, et Belgici nuncupantur, quia in Belgio an. 1619 erecti fuere. *Richard, Analyſis concilior.* iv. p. 98.

‡ An inſtance may be found in *Turgot's Memoires ſur le prêt à intéreſt, et ſur le commerce de fer.* Paris 1789, 8vo. See alſo *Gunthers Unterſuchung über wucher und wucher-geſetze.* Hamburg 1790, 8vo.

ed at Paris, under Louis XIII, in 1626; but the managers next year were obliged to abandon it *. In 1695, ſome perſons formed a capital at Marſeilles for the purpoſe of eſtabliſhing one there according to the plan of thoſe in Italy †. The preſent *mont de pieté* at Paris, which has ſometimes in its poſſeſſion forty caſks filled with gold watches that have been pledged, was, by royal command, firſt eſtabliſhed in 1777 ‡.

CHEMICAL NAMES OF METALS.

As thoſe metals earlieſt known, viz. copper, iron, gold, ſilver, lead, quickſilver and tin, received the ſame names as the neareſt heavenly bodies, which appear to us largeſt, and have been diſtinguiſhed by the like characters, two queſtions ariſe: Whether theſe names and characters were given firſt to the planets or to the metals? When, where, and on what account were they made choice of; and why were the metals named after the planets, or the planets after the metals? The

* Hiſtoire de la ville de Paris; par Sauval.

† Hiſtoire de la ville de Marſeille; par Antoine de Rufel. Marſeille 1696, fol. ii. p. 99.

‡ Tableau de Paris. Hamburg 1781, 8vo. i. p. 78.

latter of these questions, in my opinion, cannot be answered with any degree of certainty; but something may be said on the subject which will not, perhaps, be disagreeable to those fond of such researches, and who have not had an opportunity of examining it.

That the present usual names were first given to the heavenly bodies, and at a later period to the metals, is beyond all doubt; and it is equally certain that they came from the Greeks to the Romans, and from the Romans to us. It can be proved also that older nations gave other names to these heavenly bodies at much earlier periods. The oldest appellations, if we may judge from some examples still preserved, seem to have originated from certain emotions which these bodies excited in the minds of men; and it is not improbable that the planets were by the ancient Egyptians and Persians named after their gods, and that the Greeks only adopted or translated into their own language the names which those nations had given them *. The idea that each planet was the residence of a god, or that they were gods themselves, has arisen, according to the most probable conjecture, because rude nations worshipped the sun, which, on account of his beneficent

* See *Goguet, Ursprung der gesetze und künste*, ii. p. 363; from which has been taken what Bailly says in the end of his *Histoire de l'astronomie ancienne*. Paris 1775, 4to.

and

and neceſſary influence over all terreſtrial bodies, they conſidered either as the deity himſelf, or his abode, or, at any rate, as a ſymbol of him. In the courſe of time, when heroes, and perſons who by extraordinary ſervices had rendered their names reſpected and immortal, received divine honours, particular heavenly bodies, of which the ſun, moon and planets ſeemed the fitteſt, were aſſigned to theſe divinities alſo *. By what laws this diſtribution was made, and why one planet was dedicated to Saturn and not to another, Pluche, as far as I know, did not venture to determine †; and on this point the ancients themſelves are not all agreed ‡. When the planets were once dedicated to the gods, folly, which never ſtops where it begins, proceeded ſtill farther, and aſcribed to them the attributes and powers for which the deities, after whom they were named, had been celebrated in the fictions of their mythologiſts. This, in time, laid the foundation of aſtrology; and hence the planet Mars, like the deity of that name, was ſaid

* Jablonſki, Pantheon Ægyptiorum. Francofurt. ad Viadr. 1750, 8vo. in the *Prolegomena*, p. 49.

† He has however indulged in ſome conjectures, in his Hiſtory of the heavens. See *Hiſtorie des himmels*. Dreſden 1740, 2 vol. 8vo. ii. p. 64.

‡ Theſe contradictions are pointed out by Goguet, in a note, p. 370. A better view of them may be found in *Hygini Poeticon aſtronom.* xlii. p. 496, of the edition by Von Staveren.

to cauſe and to be fond of war; and Venus to preſide over love and its pleaſures.

The next queſtion is, Why were the metals divided in the like manner among the gods, and named after them? Of all the conjectures that can be formed in anſwer to this queſtion, the following appears to me the moſt probable. The number of the deified planets made the number ſeven ſo ſacred to the Egyptians, Perſians, and other nations, that all thoſe things which amounted to the ſame number, or which could be divided by it without a remainder, were ſuppoſed to have an affinity or a likeneſs to and connection with each other *. The ſeven metals, therefore, were conſidered as having ſome relationſhip to the planets, and with them to the gods, and were accordingly named after them. To each god was aſſigned a metal, the origin and uſe of which was under his particular providence and government; and to each metal were aſcribed the powers and properties of the planet and divinity of the like name; from which aroſe, in the courſe of time, many of the ridiculous conceits of the alchemiſts.

The oldeſt trace of the diviſion of the metals among the gods is to be found, as far as I know,

* Jablonſki, Panth. proleg. p. 55, 56. *Voſſius de idololatria*, ii. 34, p. 489. *Bruckeri Hiſtor. philoſoph.* i. p. 1055.

in

in the religious worſhip of the Perſians. Origen, in his Refutation of Celſus, who aſſerted that the ſeven heavens of the Chriſtians, as well as the ladder which Jacob ſaw in his dream, had been borrowed from the myſteries of Mithras, ſays, "Among the Perſians the revolutions of the heavenly bodies were repreſented by ſeven ſtairs, which conducted to the ſame number of gates. The firſt gate was of lead; the ſecond of tin; the third of copper; the fourth of iron; the fifth of a mixed metal; the ſixth of ſilver, and the ſeventh of gold. The leaden gate had the ſlow tedious motion of Saturn; the tin gate the luſtre and gentleneſs of Venus; the third was dedicated to Jupiter; the fourth to Mercury, on account of his ſtrength and fitneſs for trade; the fifth to Mars; the ſixth to the Moon, and the laſt to the Sun *. Here then is an evident trace of metallurgic

* Celſus de quibuſdam Perſarum myſteriis ſermonem facit. Harum rerum, inquit, aliquod reperitur in Perſarum doctrina Mithraciſque eorum myſteriis veſtigium. In illis enim duæ cæleſtes converſiones, alia ſtellarum fixarum, errantium alia, et animæ per eas tranſitus quodam ſymbolo repræſentantur, quod hujuſmodi eſt. Scala altas portas habens, in ſumma autem octava porta. Prima portarum plumbea, altera ſtannea, tertia ex ære, quarta ferrea, quinta ex ære mixto, ſexta argentea, ſeptima ex auro. Κλιμαξ ὑψιπυλος, επι δ'αιτῃ πυλη ογδοη. Ἡ πρωτη των πυλων μολιβδου, ἡ δευτερα κασσιτερου, ἡ τριτη χαλκου, ἡ τεταρτη σιδηρου, ἡ πεμπτη καραγου γρισματος, ἡ ἑκτη αργυρου, χρυσου δ'ἡ

metallurgic aſtronomy, as Borrichius calls it, or of the aſtronomical or mythological nomination of metals, though it differs from that uſed at preſent. According to this arrangement, tin belonged to Jupiter, copper to Venus, iron to Mars, and the mixed metal to Mercury. The conjecture of Borrichius, that the tranſcribers of Origen have, either through ignorance or deſign, tranſpoſed the names of the gods, is highly probable: for if we reflect that in this nomination men, at firſt, differed as much as in the nomination of the planets, and that the names given them were only confirmed in the courſe of time, of which I ſhall ſoon produce proofs, it muſt be allowed that the cauſes aſſigned by Origen for his nomination do not well agree with the preſent reading, and that they appear

ὅ'η ἑβδομη. Primum aſſignant Saturno tarditatem illius ſideris plumbo indicantes: alteram Veneri, quam referunt, ut ipſi quidem putant, ſtanni ſplendor et mollities; tertiam Jovi, aheneam illam quidem et ſolidam: quartam Mercurio, quia Mercurius et ferrum, uterque operum omnium tolerantes, ad mercaturam utiles, laborum patientiſſimi. Marti quintam, inæqualem illam et variam propter mixturam. Sextam, quæ argentea eſt, lunæ; ſeptimam auream ſoli tribuunt, quia ſolis et lunæ colores hæc duo metalla referunt. *Contra Celſum*, lib. vi. 22, p. 161.—I expected to have received ſome explanation of theſe words from the editors of Origen, and in thoſe authors who have treated expreſsly on the religious worſhip of the Perſians; but I find that they are quoted neither by Hyde; Philip a Turre, whoſe *Monumenta veteris Antii* is printed in *Theſaurus Antiquitat. et hiſtor. Italiæ*, viii. 4to; nor by Banier in his Mythology.

much

much juſter when the names are diſpoſed in the ſame manner as that in which we now uſe them *.

This aſtrological nomination of metals appears to have been conveyed to the Brachmans in India; for we are informed that a Brachman ſent to Apollonius ſeven rings, diſtinguiſhed by the names of the ſeven ſtars or planets, one of which he was to wear daily on his finger, according to the day of the week †. This can be no otherwiſe explained than

* Borrichius arranges the words in the following manner; Secundam portam faciunt Jovis, comparantes ei ſtanni ſplendorem et mollitiem; tertiam Veneris æratam et ſolidam; quartam Martis, eſt enim laborum patiens, æque ac ferrum, celebratus hominibus; quintam Mercurii propter miſturam inæqualem ac variam, et quia negotiator eſt; ſextam Lunæ argenteam; ſeptimam Solis auream. *Ol. Borrichius de ortu et progreſſu chemiæ.* Hafniæ 1668, 4to. p. 29. Profeſſor Eichhorn reminded me, as alluſive to this ſubject, of the ſeven walls of Ecbatana, the capital of Media, the outermoſt of which was the loweſt, and each of the reſt progreſſively higher, ſo that they all overtopped each other. Each was of a particular colour. The outermoſt was white; the ſecond black; the third purple, the fourth blue, the fifth red, or rather of an orange colour; and the ſummit of the ſixth was covered with ſilver, and that of the ſeventh or innermoſt with gold. Such is the account given by Herodotus, i. 98; and it appears to me not improbable that they may have had a relation to the ſeven planets, though nothing is hinted on that ſubject by the hiſtorian.

† Φησι δε ὁ Δαμις και δακτυλιους ἑπτα τον Ιαρχαν τῳ Απολλωνιῳ δουναι, των ἑπτα επωνυμους ἀστερων ὑυς φορειν τον Απολλωνιον κατα ἑνα προς τα ονοματα των ἡμερων. Scribit præterea Damis, Iarcham

than by ſuppoſing that he was to wear the gold ring on Sunday; the ſilver one on Monday; the iron one on Tueſday, and ſo of the reſt. Alluſion to this nomination of the metals after the gods occurs here and there in the ancients. Dydimus, in his Explanation of the Iliad, calls the planet Mars the iron ſtar *. Thoſe who dream of having had any thing to do with Mars are by Artemidorus threatened with a chirurgical operation, for this reaſon, he adds, becauſe Mars ſignifies iron †. Heraclides ſays alſo in his allegories, that Mars was very properly conſidered as iron; and we are told by Pindar that gold is dedicated to the ſun ‡.

Plato

cham ſeptem annulos Apollonio dediſſe, ſtellarum ſeptem nominibus inſignitos, quos ſingulos geſtaverit Apollonius, unum poſt alium, ut dierum nomina id ferrent. *Philoſtrat. Vita Apollonii*, iii. 41. p. 130. How was the ring for Wedneſday made? Perhaps it was hollow, and filled with quickſilver. Geſner, in *Commentaria Societat. Scien. Gotting.* 1753, iii. p. 78, thinks that theſe rings might only have been made or caſt under certain conſtellations.

* Iliad. v. Επει γαρ ὁ Αρειος ασηρ, ὁ σιδηρειος καλουμενος.

† Viſus eſt ſibi quis a Marte iniri, affectio ipſi facta eſt circa ſedem et meatum, et cum non poſſet alio aliquo modo curari, ſectione uſus curatus eſt. Significabat enim Mars ferrum, quem ad modum etiam conſuetudine tranſnominative per metonymiam appellamus. *Oneirocritica*, v. 37.

‡ Iſthm. od. ver. 1. Of the like kind are many paſſages in Euſtathius on Homer's Iliad, b. xi. and alſo the following paſſages of Conſtantinus Manaſſes, where he deſcribes the creation of

Plato likewiſe, who ſtudied in Egypt, ſeems to have admitted this nomination and meaning of the metals. We are at leaſt aſſured ſo by Marſilius Ficinus *; but I have been able to find no proof of it, except where he ſays of the iſland Atlantis, that the exterior walls were covered with copper and the interior with tin, and that the walls of the citadel were of gold †. It is not improbable that Plato adopted this Perſian or Egyptian repreſentation, as he aſſigned the planets to the demons; but perhaps it was firſt introduced into his ſyſtem

of the ſtars, in his *Annales*, edition of Meurſius, Leyden 1616, 4to. p. 7 and p. 263: Saturnus nigricabat, colore plumbeo; Jupiter ut argentum ſplendebat; Mars flammeus conſpiciebatur; Sol inſtar auri puri lucebat; (Venus uti ſtannum): Mercurius inſtar æris rubebat; Luna in morem glaciei pellucida ſuam et ipſa emittebat, &c. Euſtathius on *Dionyſ. Periegeſ.* v. 288, ſays: το μεταλλον του χρυσου τω Ηλιω ανακειται. Aurum ſoli dedicatum eſt; not *ſoli accumbit*, as tranſlated by Bertrand. Olympiodorus uſes the word in the ſame ſenſe.

* Commemorat et metalla, ut per ſeptem metalla, ſeptem planetarum influxus intelligamus, generationem omnium moderantes. Aurum quidem Soli, argentum Lunæ, plumbum Saturno, electrum Jovi, ferrum et æs Marti, Veneri aurichalcum, Mercurio ſtannum, Platonici tribuunt. In his Preface to Critias. *Platonis Opera*; Francof. 1602, fol. p. 1097.

† Muri, qui exteriorem orbem claudebat, ſuperficiem omnem ære tenui veſtierunt; ejus vero qui interiorem, ſtanno; ejus denique qui circumdabat arcem, aurichalco, igneo fulgore corufco. Regio vero ipſa intra arcem, ita conſtructa: In medio ſacrum et inacceſſibile Clitonis Neptunique templum, aureo ambitu circumdatum. P. 1105.

only

only by his disciples *. They seem, however, to have varied from the nomination used at present; as

* It is probable that Ficinus had in view a passage in *Olympiodori Commentar. in Meteora Arist.* which, as it remarkable, and as that work is scarce, I have here transcribed. It may be found lib. iii. p. 59, in the edition of Venice 1551, fol. Ισεον δε και τουτο, ὁτι θειος Προκλος εν τοις εις Τιμαιον ὑπομνημασιν αναγει τα μεταλλα εις τους ἑπτα πλανωμενους, λεγων ανακεισθαι τον μεν μολιβδον τῳ Κρονῳ δια το βαρυ και συγγον και ψυχρον. Το δε ηλεκτρον τῳ Δι δια το ευκρατον και ζωογονον του αερος, ὁμοιως δε και μιγμα τιμιωτερον εστι χρυσου και ευκρατον. Τῳ δε Αρει τον σιδηρον, δια το τμητικον και οξυ. Ἡλιῳ δε τον χρυσιν, ὡσανει πηγη φωτος ουτι. Αφροδιτῃ δε τον χαλκον δια το ανθηρον, και ὁτι πλησιον εστι του ἡλιου, ὡσπερ και χαλκος του χρυσου. Ἑρμῃ δε τον κασσιτερον δια το διαφανες και γιλπνον, ἁμα δε και δια το πλησιον ειναι της σεληνης, ὡσπερ ὁ κασσιτερος του αργυρου. Τῃ δε Σεληνῃ τον αργυρον, ἐπειδη και ὁ αργυρος παρα χρυσῳ τιθεμενος δοκει καταλαμπεσθαι ὑπο του χρυσου και φωτεινοτερος γινεσθαι, ὡσπερ ἡ σεληνη ὑπο ἡλιου καταλαμπεται. Illud quoque sciendum, quemadmodum divinus Proclus in suis in Timæum commentariis ad septem planetas metalla omnia revocat; cum dicit plumbum quidem Saturno dicatum propter vim gravem et tristem et frigidam. Electrum autem Jovi propter naturam sideris temperatam et vitæ largientem. Simili autem modo et migma; migma vero majori æstimatione dignum est, magisque temperatum quam sit aurum. Marti vero ferrum consacrat propter acutum ruboris et vim cædendi. Soli autem aurum ipsum, tanquam qui universi luminis fons existat. Vult æs deinde Veneri dicatum propter floridum fulgorem, et quia sole non omnino diversam habet naturam, sicut æs quoque ad auri speciem propius accedit. Mercurio vero stannum proprium dicat propter translucidum et fulgidum nitorem; simulque quia lunæ proximus adjacet, sicut stannum prope argenti naturam est. Lunæ autum sacrum argentum est, quoniam argentum auro in proximo adjacens lucem ab ipso au-

ro

as they dedicated to Venus copper, or braſs, the principal component part of which is indeed copper; to Mercury tin, and to Jupiter electrum. The laſt-mentioned metal was a mixture of gold and ſilver; and on this account was probably conſidered to be a diſtinct metal, becauſe in early periods mankind were unacquainted with the art of ſeparating theſe noble metals *.

The characters by which the planets and metals are generally expreſſed when one does not chooſe to write their names, afford a ſtriking example how readily the mind may be induced to ſuppoſe a connection between things which in reality have no affinity or relation to each other. Antiquaries and aſtrologers, according to whoſe opinion the planets were firſt diſtinguiſhed by theſe characters, conſider them as the attributes of the deities of the ſame name. The circle in the earlieſt periods among the Egyptians was the ſymbol of divinity

ro accipere videtur, et ſplendidus effici, more lunæ quæ luce ſolis undique colluſtratur. — According to the tranſlation of Camotius, printed by itſelf, at Venice 1567, fol. p. 203.

* This diſtribution, which is aſcribed to the Platoniſts, may be found alſo in the ſcholiaſts on Pindar, at the beginning of the fifth Iſthmian Ode, p. 459: Εκαστω δε των αστερων, ὑλη τις ανατεται. Ἡλιῳ μεν ὁ χρυσος. Σεληνῃ δε, ὁ αργυρος. Αρει, σιδηρος. Κρονῳ, μολιβδος. Διι ηλεκτρος. Ερμῃ, κασσιτερος. Αφροδιτῃ, χαλκος. This confirms what I have before ſaid, that mankind at firſt were not unanimous in this diviſion of the metals among the gods.

and perfection; and ſeems with great propriety to have been choſen by them as the character of the ſun, eſpecially as, when ſurrounded by ſmall ſtrokes projecting from its circumference, it may form ſome repreſentation of the emiſſion of rays. The ſemicircle is, in like manner, the image of the moon, the only one of the heavenly bodies that appears under that form to the naked eye *. The character ♄ is ſuppoſed to repreſent the ſcythe of Saturn; ♃ the thunderbolts of Jupiter; ♂ the lance of Mars, together with his ſhield; ♀ the looking-glaſs of Venus; and ☿ the caduceus or wand of Mercury †.

The expreſſion by characters adopted among the chemiſts agrees with this mythological ſignification only in the character aſſigned to gold.—Gold, according to the chemiſts, was the moſt perfect of metals, to which all others ſeemed to be inferior in different degrees. Silver approached neareſt to it; but was diſtinguiſhed only by a ſemicircle, which, for the more perſpicuity, was drawn double, and thence had a greater reſemblance to the moſt remarkable appearance of the moon; the name of which this metal had already

* Clemens, in his *Stromata*, lib. iv. p. 556, ſpeaking of the Egyptian hieroglyphics, ſays: Qui ſolem volunt ſcribere, faciunt circulum; lunam autem, figuram lunæ cornuum formam præ ſe ferentem, convenienter ei formæ, quæ propric dicitur.

† Riccioli Almageſt. novum, vii. 1. vol. 1. p. 480.

obtained

obtained. All the other metals, as they ſeemed to have a greater or leſs affinity to gold or ſilver, were diſtinguiſhed by characters compoſed of the characters aſſigned to theſe precious metals *. In the character ☿ the adepts diſcover gold with a ſilver colour. The croſs placed at the bottom, which among the Egyptian hieroglyphics had a myſterious ſignification ☥, expreſſes, in their opinion, ſomething I know not what, without which quickſilver would be ſilver or gold. This ſomething is combined alſo with copper, the poſſible change of which into gold is expreſſed by the character ♀. The character ♂ declares the like honourable affinity alſo; though the ſemicircle is applied in a more concealed manner; for, according to the propereſt mode of writing, the point is wanting at the top, or the upright line ought only to touch the horizontal, and

* Wilh. Chriſtoph. Kriegſmann, Taaut, oder Auflegung der chymiſchen zeichen, damit die metallen und andere ſachen von alters her bemerkt werden. Frankfurt 1665, ſix ſheets octavo. This work contains nothing but chemical reveries. In reſearches of this kind I conſider it as my duty to mention thoſe books, the titles of which may ſeem to promiſe information on the ſubject, while at the ſame time they contain nothing worth notice. It is proper that my readers ſhould know there are ſuch works, and that they may ſave themſelves the trouble of conſulting them.

† Jablonſki, Pantheon Ægypt. i. p. 282, 283, 287; and ii. p. 131. This author makes it the repreſentation of ſomething which cannot be well named. *Kircheri Œdipus Ægypt.* t. ii. pars ii. p. 399. Romæ 1653. fol.

not to interſect it. Philoſophical gold is concealed in ſteel; and on this account it produces ſuch valuable medicines. Of tin one half is ſilver, and the other conſiſts of the ſomething unknown: for this reaſon the croſs with the half moon appears in 4. In lead this ſomething is predominant, and a ſimilitude is obſerved in it to ſilver. Hence in its character ♄ the croſs ſtands at the top, and the ſilver character is only ſuſpended on the right hand behind it *.

The mythological ſignification of theſe characters cannot be older than the Grecian mythology; but the chemical may be traced to a much earlier period. Some, who conſider them as remains of the Egyptian hieroglyphics †, pretend that they may be diſcovered on the table of Iſis, and employ them as a proof of the high antiquity, if not of the art of making gold, at leaſt of chemiſtry. We are told alſo that they correſpond with many other characters which the adepts have left us as emblems of their wiſdom.

If we are deſirous of deciding without prejudice reſpecting both theſe explanations, it will be found

* Boerhaave, Elementa chemiæ. Lugd. Bat. 1732, 4to. i. p. 32. See alſo Kircher ut ſupra, p. 171.

† Goguet, ii. p. 370, 371, conſiders them as remains of the original hieroglyphics; but he is of opinion that we received them in their preſent form from the Arabians.

neceſſary

neceſſary to make ourſelves acquainted with the oldeſt form of the characters, which, in all probability, like thoſe uſed in writing, were ſubjected to many changes before they acquired that form which they have at preſent. I can, however, mention only three learned men, Saumaiſe *, Du Cange †, and Huet ‡, who took the trouble to collect theſe characters. As I am afraid that my readers might be diſguſted were I here to inſert them, I ſhall give a ſhort abſtract of the concluſion which they form from them; but I muſt firſt obſerve that the oldeſt manuſcripts differ very much in their repreſentation of theſe characters, either becauſe they were not fully eſtabliſhed at the periods when they were written, or becauſe many ſuppoſed adepts endeavoured to render their information more enigmatical by wilfully confounding the characters; and it is probable alſo that many miſtakes may have been committed by tranſcribers.

The character of Mars, according to the oldeſt mode of repreſenting it, is evidently an abbreviation of the word Θουρος, under which the Greek ma-

* Plinianæ Exercitat. in Solinum, p. 874.

† Gloſſarium ad ſcriptores med. et infimæ Græcitatis. Lugduni 1688. fol. At the end of the Appendix, p. 5 and 6.

‡ In his Annotations on *Manilii Aſtronomicon*, added to the edition by Michael Fayus *in uſum Delphini*. Pariſiis 1679, 4to. p. 80.

thematicians underſtood that deity *; or, in other words, the firſt letter Θ, with the laſt letter ς placed above it. The character of Jupiter was originally the initial letter of Ζευς; and in the oldeſt manuſcripts of the mathematical and aſtrological works of Julius Firmicus the capital Z only is uſed, to which the laſt letter ς was afterwards added at the bottom, to render the abbreviation more diſtinct. The ſuppoſed looking-glaſs of Venus is nothing elſe than the initial letter, diſtorted a little, of the word Φωσφορος, which was the name of that goddeſs. The imaginary ſcythe of Saturn has been gradually formed from the two firſt letters of his name Κρονος, which tranſcribers, for the ſake of diſpatch, made always more convenient for uſe, but at the ſame time leſs perceptible. To diſcover in the pretended caduceus of Mercury the initial letter of his Greek name Στιλβων, one needs only look at the abbreviations in the oldeſt manuſcripts, where they will find that the Σ was once written as C; they will remark alſo that tranſcribers, to diſtinguiſh this abbreviation from the reſt ſtill more, placed the C thus ↄ, and added under it the next letter τ. If thoſe to whom this deduction appears improbable will only take the trouble to look at other Greek abbreviations, they will find many that differ ſtill farther from the original letters they expreſs than the preſent character ☿ from the C and

* This is proved by Saumaiſe, p. 872.

τ united.

♄ united. It is poſſible alſo that later tranſcribers, to whom the origin of this abbreviation was not known, may have endeavoured to give it a greater reſemblance to the caduceus of Mercury. In ſhort, it cannot be denied that many other aſtronomical characters are real ſymbols, or a kind of proper hieroglyphics, that repreſent certain attributes or circumſtances, like the characters of Aries, Leo, and others quoted by Saumaiſe.

But how old is the preſent form of theſe characters? According to Scaliger *, they are of great antiquity, becauſe they are to be found on very old gems and rings. If the ring number 104 in Goræus be old and accurately delineated, this muſt indeed be true; for ſome of theſe characters may be very plainly diſtinguiſhed on the beazel †. We are told by Wallerius‡, that they were certain-

* In his Annotations on *Manilii Aſtronomicon*. Straſburgh 1665, 4to. p. 460. Quam vetuſti ſint characteres planetarum, argumento ſunt vetuſtiſſimæ gemmæ, et palæ annulorum, in quibus eæ inciſæ viſuntur.

† In *Gori, Theſaurus Gemmarum antiquarum aſtriferarum*, Florentiæ 1750, 3 vol. fol. I found nothing on this ſubject. Characters of the moon and of the ſigns in the zodiac often occur; but no others are to be ſeen, except in tab. 33, where there is a ring, which has on it the preſent characters of Mars and Venus. In general the planets are repreſented by ſeven ſmall aſteriſks, or by ſix and the character of the moon. Beſides, the antiquity of this gem cannot be aſcertained.

‡ Phyſiſche chemie, i. p. 48.

ly uſed by the ancient Egyptians, becauſe Democritus, who reſided five years in Egypt, ſpeaks of them in the plaineſt terms. I do not know whence Wallerius derived this information, but it proves nothing. He undoubtedly alludes to the laughing philoſopher of Abdera, who lived about four hundred and fifty years before our æra, but no authentic writings of his are now extant. Fabricius * ſays that we have a Latin tranſlation of a work of his *De arte ſacra*, Patavii 1572, which, however, is certainly a production of much later times. I

* It appears that he never ſaw the book; for in vol. i. p. 809, he miſquotes both the title and the date. The whole title is, *Democritus Abderita de arte magna, ſive de rebus naturalibus. Nec non Syneſii et Pelagii, et Stephani Alexandrini, et Michaelis Pſelli, in eundem commentaria.* Dominico Pizimentio Vibonenſi interprete. Patavii 1573, nine ſheets ſmall octavo. The editor, however, ſays in the preface: Democriti Abderitæ libellum de arte magna, et Syneſium ejuſdem interpretem, ereptum a Corcyræo quodam, qui Venetiis Romam ſe contulerat, in Latinum converti. In p. 5 ſtands: Ex rebus naturalibus V myſticis Democriti, and in p. 11 follows: Dioſcoro ſacerdoti magni Serapidis in Alexandria, Deo favente, Syneſius philoſophus ſ. p. d. and alſo a letter, p. 18: Pelagii Philoſophi de eadem magna arte. P. 23. Steph. Alexandrini, œcumenici philoſophi et magiſtri magnæ hujus artis, auri conficiendi actio prima. D. Pizimentio interprete. There are nine *actiones*. At the end ſtands: Michaelis Pſelli Epiſtola ad Xiphilinum patriarcham, de auri conficiendi ratione. D. Pizim. Vibon. interprete. Conring ſays in his *Hermetica medicina*, p. 29, that this book was printed four years after at Cologne, with *Mizaldi Mirabilia*. Salmaſius, in his Annotations on Tertullian *De pallio*, p. 188, 189, gives two receipts from the Greek original.

have

have it now before me from the library of our univerſity; and I find that it is not the whole book, but only an abſtract, and written in ſo extravagant a manner, that the deception is not eaſily diſcovered. It contains chemical proceſſes, but nothing of the characters of metals; which is the caſe alſo with the letters of Democritus, publiſhed by Lubbinus *.

ZINC.

ZINC is one of thoſe metals which were not known to the Greeks, Romans, or Arabians. This we have reaſon to conjecture, becauſe it has not been diſtinguiſhed by a chemical character like the reſt; but it is fully proved, by our not finding in the works of the ancients, any information that even appears to allude to it. I know alſo but of one inſtance where it is ſuppoſed to have been found among remains of antiquity. Grignon pretends that ſomething like it was diſcovered in the ruins of the ancient Roman city in Champagne †. Such an unexpected diſcovery deſerved to have

* See the collection of Greek letters of *Eilh. Lubbinus*. Ex officina Commelina, 1601, 8vo.

† Bulletin des fouilles d'une ville Romaine, p. 11.

been examined with the utmoſt minuteneſs; but it ſeems to have been examined only in a very ſuperficial manner; and as that was the caſe, it is impoſſible to gueſs what kind of a metal or metallic mixture this author conſidered as zinc.

It is not ſurpriſing that this metal ſhould have remained ſo long unknown, for it has never yet been found pure *. Its principal component part is often and in a great degree mixed with ores; and when theſe are melted, it becomes ſublimated in a metallic form, and is found adhering above to the cool ſides of the furnace; but a particular apparatus is neceſſary, elſe the reduced metal partly evaporates, and is partly calcined, by which means it appears like an earthy cruſt, and exhibits to the eye no traces of metal.

That mixture of zinc and copper called at preſent braſs, tomback, pinchbeck, princes-metal, &c. and which was firſt diſcovered by ores, abundant in zinc, yielding when melted not pure copper, but braſs, was certainly known to the ancients. Mines that contained ores, from which this gold-coloured metal was produced, were held in the higheſt eſtimation; when exhauſted, the loſs of them was regretted; and it was ſuppoſed that

* See Gmelins Grundriſſe der Mineralogie. Gottingen 1790, 8vo. p. 440.

the

the metal would never be again found. In the courſe of time it was remarked, no one knows by what accident, that an earth, which muſt have been calamine, when added to copper while melting, gave it a yellow colour. This earth was therefore uſed, though it was not known to what metal it belonged, in the ſame manner as calx of cobalt was employed in colouring glaſs before mineralogiſts were acquainted with that metal itſelf. Ariſtotle and Strabo ſpeak of an earth of that kind, the uſe of which in making braſs has been retained through every century. Ambroſius, biſhop of Milan, in the fourth century; Primaſius, biſhop of Adrumetum in Africa, in the ſixth; and Iſidore, biſhop of Seville, in the ſeventh, mention an addition by which copper acquired a gold colour, and which undoubtedly muſt have been calamine*. When, in the courſe of time, more calamine was

* The firſt ſays, in his Expoſition of the book of Revelation, chap. 1: Æs namque in fornace, quibuſdam medicaminibus admixtis, tamdiu conflatur, uſque dum colorem auri accipiat, et dicitur aurichalcum. The ſecond ſays, on the ſame paſſage: Aurichalcum ex ære fit, cum igne multo, et medicamine adhibito, perducitur ad aureum colorem. - - - - *Iſidor. in Origin.* Aurichalcum dictum quod et ſplendorem auri et duritiam æris poſſideat: fit autem ex ære et igne multo, ac medicaminibus perducitur ad aureum colorem. - - - Have theſe biſhops copied each other? I ſhould here give the hiſtory of braſs *(aurichalcum)*, had I not ſaid a great deal on that ſubject in the annotations to *Ariſtot. Auſcult. mirab.* and were I not afraid that it might be conſidered as a repetition.

diſcovered,

diſcovered, the ancient method of procuring braſs from copper-ore that contained zinc was abandoned; and it was found more convenient firſt to extract from it pure copper, and then to convert it into braſs by the addition of calamine.

Thoſe deſirous of enquiring farther into the knowledge which the ancients had of this metal muſt examine the meaning of the word *cadmia*, which ſeems to have had various ſignifications. This taſk I have ventured to undertake; and though I cannot clear up every thing that occurs reſpecting it, I ſhall lay before my readers what information I have been able to obtain on the ſubject, becauſe perhaps it may amount to ſomewhat more than is to be found in the works of old commentators. *Cadmia* ſignified then, in the firſt place, a mineral abounding in zinc, as well as any ore combined with it, and alſo that zinc-earth which we call calamine. Thoſe who ſhould underſtand under it only the latter, would not be able to explain the greater part of the paſſages in the ancients where it is mentioned. It is probable that ore containing zinc acquired this name, becauſe it firſt produced braſs *. When it was afterwards remarked, that calamine gave to copper a yellow co-

* Plin. lib. xxxiv. ſect. 22: Ipſe lapis, e quo fit æs, cadmia vocatur.

lour,

lour, the ſame name was conferred on it alſo. It appears, however, that it was ſeldom found by the ancients *; and we muſt conſider *cadmia*, in general, as ſignifying ore that contained zinc. Gold-coloured copper, or braſs, was long preferred to pure or common copper, and thought to be more beautiful the nearer it approached to the beſt *aurichalcum*. Braſs therefore was ſuppoſed to be a more valuable kind of copper; and on this account Pliny ſays, that *cadmia* was neceſſary for procuring copper, that is braſs. Copper, as well as braſs, was for a great length of time called *æs*, and it was not till a late period that mineralogiſts, in order to diſtinguiſh them, gave the name of *cuprum* to the former †. Pliny ſays, that it was good when a large

* Zinc-earth, beſides being mentioned by Ariſtotle and Strabo, is mentioned alſo by Galen *De Simplic. medicam. facultatibus*, lib. ix. p. 142. As he found no furnace-calamine *(ofenbruch)* when he reſided in Cyprus, he procured from the overſeer of the mines ſome raw *cadmia*, which had been found in the mountains and rivulets, and which certainly muſt have been calamine.

† At firſt it was called *æs cyprium*, but in the courſe of time only *cyprium*; from which was at length formed *cuprum*. It cannot however be aſcertained at what periods theſe appellations were common. The epithet *cupreus* occurs in manuſcripts of Pliny and Palladius; but one cannot ſay whether later tranſcribers may not have changed *cyprius* into *cupreus*, with which they were perhaps better acquainted. The oldeſt writer who uſes the word *cuprum* is Spartian; who ſays, in the Life of Caracalla, *cancelli ex ære vel cupro*. But may not the laſt word have been added to

large quantity of *cadmia* had been added to it, becauſe it not only rendered the colour more beautiful, but increaſed the weight. In the like manner, a quintal of copper in Hungary produces an hundred and fifty pounds of braſs. The ſame author remarks alſo, that the *cadmia (foſſilis)* was not uſed in medicine: this however is to be underſtood only of the raw ore, for ſome phyſicians prepared zinc-earth from ore that contained zinc, as he afterwards tells us; and Galen extols the calamine found in Cyprus on account of its ſuperior effects, becauſe, perhaps, the earth could be obtained from it much purer.

In the ſecond place, *cadmia*, among the ancients, was what we call *(ofenbruch)* furnace-calamine, or what in melting ore that contains zinc, or in mak-

to the text as a gloſs? Pliny, book xxxvi. 26, ſays: Addito *cyprio et nitro*; which Iſidore, xvi. 15. p. 393, expreſſes by the words *adjecto cupro et nitro*. The ſuperiority of the Cyprian copper gave occaſion to this appellation; as the beſt iron or ſteel was called *chalybs*, from the *Chalybes* (a people of Galatia) who prepared the fineſt, and carried on the greateſt trade with it. But in what did the ſuperiority of this Cyprian copper conſiſt? In its purity, or in its colour, which approached near to that of gold? That iſland produced a great deal of ore which contained zinc, and abounded alſo with calamine. Pliny ſays, *in Cypro prima fuit æris inventio*. Red copper however had been known there from the earlieſt periods, ſo that the honour of its invention muſt be allowed to that iſland without any contradiction; and Pliny muſt undoubtedly allude in the above paſſage to ſome particular kind.

ing braſs, falls to the bottom of the furnace, and which conſiſts of more or leſs calcined zinc *. As this furnace-calamine aſſumes various appearances, according to the manner of melting, and according to many other circumſtances that in part cannot be defined; and as the ancients comprehend all its varieties under the general name of *cadmia*, and give to each variety, according to its form, conſiſtence and colour, a particular name alſo, a confuſion of names has hence ariſen which cannot now be cleared up, eſpecially as it is not thought worth while to diſtinguiſh all its incidental variations. Our phyſicians eſteem only the pure zinc-earth; and as they know how to obtain it, they are not under the neceſſity of uſing impure furnace-calamine. In our melting-houſes it is employed, without much nicety in the choice, for making zinc or braſs †.

What

* Pliny ſays, p. 659: Fit ſine dubio cadmia et in argenti fornacibus, ſed nequaquam comparanda æriariæ. Dioſcorides ſays the ſame. Some ſuppoſe that the author means litharge; but he ſpeaks of ſilver-ore mixed with zinc, which certainly will produce *(ofenbruch)* furnace-calamine.

† I ſhall embrace this opportunity of preſenting to thoſe fond of critical remarks, a few obſervations on Dioſcorides. In book v. c. 84, he firſt mentions ſome ſorts of *cadmia*, βοτρυιτις, πλακωτη and ὀστρακιτις. Theſe, according to Galen and Pliny, are undoubtedly certain kinds of *(ofenbruch)* furnace-calamine; but Saumaiſe in his book *De homonymis*, p. 230, and Sarracen in his Annotations, p. 113, are of opinion that Dioſcorides conſidered them

What here appears to me moſt ſingular is, that the ancients ſhould have given the ſame names to furnace-calamine *(ofenbruch)* as they gave to ores that contained zinc. The affinity of theſe ſubſtances they could conjecture only from their effects, or perhaps they were induced to do ſo from obſerving

them as native kinds of *cadmia*, or minerals abundant in zinc. Firſt, becauſe he ſays: τοιαυται δε εισιν αι εκ των παλαιων μεταλλων ορυσσομεναι, tales ſunt quæ e fodinis veteribus eruuntur; and ſecondly, becauſe he begins afterwards to ſpeak for the firſt time of factitious *cadmia*, or furnace-calamine, where he ſays: γενναται δε ἡ καδμεια εκ του χαλκου καμινευομενου. I cannot however allow myſelf to believe that Dioſcorides, who was ſo careful, and who immediately after deſcribes the artificial preparation of *cadmia* clearly and properly, ſhould have thus erred. Beſides, every kind of *ofenbruch* (furnace-calamine) muſt have diſcovered its origin from fire to ſuch a good judge of minerals as Dioſcorides. I am convinced that he, as well as Galen and Pliny, conſidered the above kinds as furnace-calamine. The words τοιαυται δε εισιν αι εκ των π. μ. ὁ. were not written by him, and are only an annotation made by ſome perſon on the paſſage, and inſerted afterwards in the text by an inattentive tranſcriber. Such inſertions, in my opinion, are more frequent in Dioſcorides than in any other author. His works were a kind of manual to phyſicians, in which each made ſuch obſervations as he thought proper. The words γενναται δε ἡ καδμεια εκ τ. χ. κ. by no means form a tranſition to the artificial kinds of *cadmia*. The author only begins there to give an account how the before-deſcribed kinds of *cadmia* were produced or prepared. The tranſlation: Gignitur porro et cadmia quædam e fuligine, quæ, dum excoquitur æs, lateribus cameriſque fornacum applicatur, is entirely wrong. It ought to be: Fit autem cadmia. - - - The former has ariſen from the reading γενναται δε τις καδμεια, found in ſome manuſcripts; and

obſerving that furnace-calamine was not produced but when the different kinds of *cadmia*, as they were called, were melted; that is, when yellow and not red copper was obtained. *Ofenbruch* got the name of furnace-calamine at Rammelſberg, when it was obſerved that it could be employed inſtead of native calamine for making braſs *. Were the ancients then in any meaſure acquainted with this

and thoſe tranſcribers have been conſidered to be right, who, on account of the preceding words, εκ των παλαιων μεταλλων, ſeemed to be convinced that Dioſcorides had hitherto ſpoken of native calamine.

Pompholyx was the name of the white flowers of zinc which Dioſcorides, v. 85. p. 352, compares to wool, and which by chemiſts were formerly called *lana philoſophica*. That author ſays: ερίων τολυπαις αφομοιουται, lanarum carptarum flocculos imitatur. The ancients collected theſe flowers when produced by the melting of zinc-ore; but they obtained them alſo by an apparatus which is fully deſcribed by Dioſcorides and Galen, and which approaches near to that uſed for collecting arſenic in the poiſon melting-houſes as they are uſually called.—That theſe flowers are named alſo *nicht*, and furnace-*nicht*, is well known. Friſch conjectures that this name was derived from *onychites*, which ſignified a kind of furnace-droſs. After this derivation was forgotten, the word was tranſlated *nihil* and *nihilum*; and in the ſame manner from glaſs-gall has ariſen *fel vitri*.

* This however I will not with certainty affirm. As *calmey* and *galmey* have probably taken their riſe from *cadmia* or *calimia*, and as both theſe words ſignified proper calamine, as well as *ofenbruch*, the latter, perhaps, may at an earlier period have ſignified furnace-calamine.

uſe

uſe of it? Galen and Dioſcorides ſpeak only of its uſe in medicine, and ſay nothing of its being employed in the preparation of braſs. The Arabian writers, particularly the tranſlators of the Greek phyſician, ſpeak in a much clearer manner of the preparation of braſs; but the appellations which they employ are ſo indeterminate in their ſignification, that an anſwer to that queſtion cannot be deduced from them. *Climia*, which ſome pronounce *calimia*, and from which the modern Greeks made *kelimia*, and the Latins *lapis calaminaris*, ſeems to have entirely the ſame meaning as *cadmia*. *Tutia*, which occurs firſt in the eleventh century, in Avicenna, and which the Greeks write *toutia*, or perhaps more properly *thouthia*, ſignifies ſometimes *pompholyx*; but, in common, it ſeems to expreſs alſo minerals that contain zinc, and likewiſe furnace-calamine *. Could it be proved that the *tutia* of the Arabs and latter Greeks was furnace-calamine, or the *tutia* of our druggiſts, the oldeſt account with which I am acquainted of furnace-calamine, employed in making braſs, would occur in Zoſimus, who, according to every appearance,

* Proofs reſpecting this ſubject may be found in *Salmaſius de homonymis*. I ſhall quote only one paſſage from Serapion, p. 277: Ex tutia eſt quædam quæ invenitur in mineris, et ex ea eſt quæ fit in fornacibus, in quibus citrinatur æs, et colligitur et reponitur, ſicut climia. Cementation of copper was called *citrinatio æris*; by the Greeks ποιησις χαλκου ξανθου, or ξανθωσις χαλκου.

lived

lived in the fifth century *. This author tells us, that, in order to make braſs, Cyprus copper muſt be melted, and pounded *tutia* muſt be ſtrewed over it. Saumaiſe ſuſpects that Zoſimus here means only calamine: but however this may be, his receipt has been retained till the preſent time in books on the arts; for theſe recommend not calamine but *tutia*. Notwithſtanding this, we are ſtill ignorant where and how the ſubſtance is prepared which is ſold under that name; but it evidently appears to the eye, that it is a mixture of calciform zinc and burnt earth †.

We can with more certainty affirm, that this uſe

* It is not certainly known when this Zoſimus Panoplitanus lived. His works, which muſt contain abundance of information reſpecting the hiſtory of chemiſtry, have never yet been printed. The greater part of them were preſerved in the King's library at Paris. The receipt to which I allude has been inſerted by Saumaiſe, p. 237.

† Neumann's Chemie; von Keſſel, iv. 2. p. 657. *Fallopius de metal.* p. 307, ſays, it is made at Venice, which appears to me moſt probable, though it occurs alſo in the bills of lading of Eaſt India ſhips. We read in *Obſervations ſur la phyſique*, vi. p. 255, that for many years *tutia* has been collected and ſold in the biſhopric of Liege. Lehmann endeavours to ſhew that it was made by the Jews in Poland. *Novi commentarii Academ. Petropolit.* xii. p. 381. As the uſe of tutia has been almoſt abandoned, becauſe phyſicians prefer pure flowers of zinc, and becauſe thoſe who make pinchbec employ purified zinc; it is probable that this ſubſtance will ſoon be entirely neglected.

of furnace-calamine, in making braſs, was known to Albertus Magnus in the thirteenth century; for he ſays, firſt, that yellow copper was made by the addition of calamine, which he calls *lapis calaminaris*. He tells us afterwards, that Hermes taught how to give a gold colour to copper by throwing pounded *tutia* into the melted metal. *Tutia*, ſays he, which is uſed in the tranſmutation of metals, is not a native mineral, but an artificial mixture, produced in the furnace when copper-ore is melted; and he adviſes glaſs-gall to be ſtrewed over the ore, otherwiſe calamine and *tutia* will loſe their force in the fire *. It would appear that the laſt-mentioned name, in the thirteenth century, ſignified only furnace-calamine, and that its uſe for making braſs was at that period known.

For many centuries however, the *ofenbruch*, furnace-calamine, with which, as we are told, the furnaces at Rammelſberg overflowed, was thrown aſide as uſeleſs, till at length, in the middle of the ſixteenth century, Eraſmus Ebener firſt ſhewed that it might be uſed inſtead of native calamine for making braſs. This Ebener, deſcended from the

* Ligatur autem per oleum vitri; tolluntur enim fragmenta vitri, et convertuntur in pulverem, et ſpargitur in teſtam ſuper æs poſtquam immiſſa eſt calaminaris, et tunc vitrum projectum enatat ſuper æs, et non ſinit evaporare lapidem et lapidis virtutem, ſed reflectit vaporem lapidis in æs. *De mineralibus*. Coloniæ 1569, 12mo. p. 350. lib. iv. cap. 5; and lib. v. cap. 7. p. 388.

noble family of that name at Nuremberg, was a man of great learning, and an able ſtateſman. He was employed by his native city, and by foreign princes, on occaſions of the higheſt importance. In 1569, he was privy-counſellor to Julius duke of Brunſwick, and died in 1577, at Helmſtadt, where he was buried *. I regret much that I can give no farther account of this important diſcovery than what I have inſerted in my introduction to Technology. The time even when it was made, is not known with certainty. Lohneyſs ſays, that it was ſixty years before the period when he wrote. But at what period did he write? The oldeſt edition, with which I am acquainted, of his treatiſe on mines is of the year 1617, ſo that this diſcovery would fall about the year 1557 †. Calvor cauſed to be printed an old account of the Rammelſberg mines, which was ſaid to have been publiſhed in 1565. According to that work, Eraſmus Ebern (for ſo was the name there improperly written) made the above-mentioned obſervation at Nuremberg, about ſeventeen years before, that is, about

* Doppelmayrs Nachricht von Nürnbergiſchen Künſtlern, p. 77.

† The other edition was printed at Stockholm and Hamburgh, by Liebezeit, and is the ſame as that mentioned by H. Gatterer, in *Anleitung den Harz zu bereiſen*, i. p. 313, and ii. p. 13.

the year 1548 *. Schluter † assigns as the period, about 1550, and Honemann ‡ about 1559. We may therefore very safely place it in the middle of the sixteenth century, and probably the discovery happened in 1553, at which time Ebener was sent to duke Henry, with whom he continued a long time, as we are expressly told by Doppelmayr. This use of calamine refuse induced the managers of the profitable brass-works in the Harz forest to pick up carefully that which had there been before thrown aside. Duke Julius, who endeavoured to improve every branch of manufacture, and particularly what related to metallurgy, and who, agreeably to the then prevailing and apparently returning mode of princes, suffered himself to be duped with the hopes of making gold, improved the brass-works at Buntheim, below Harzburg, and by these means brought a great revenue to the electoral treasury ||.

Another production of zinc, artificial white vi-

* Historische nachricht von den Unter- und Ober-Harzischen bergwerken. Braunschw. 1765, fol. p. 208.

† Von hüttenwerken, p. 235.

‡ Die Alterthümer des Harzes. Clausthal 1754, 4to. ii. p. 119 and 124.

|| Rehtmeiers Braunschweig-Luneburgische Chronik. Braunschweig 1722, fol. p. 1063.

triol,

triol, was alſo long prepared, uſed, and employed in commerce before it was known that it was procured from this ſemi-metal. That it was not known before the middle of the ſixteenth century, and that it was firſt made at Rammelſberg, may with confidence be affirmed. Schluter aſcribes the invention of it to duke Julius, and places it in the year 1570 *: but it muſt be ſomewhat older than the above-quoted account of Rammelſberg; for the author, who wrote about 1565 †, relates, that in his time one citizen only, whom he calls Henni Balder, boiled white vitriol; and it appears that this perſon kept the proceſs a ſecret. That the invention however was not then new, is evident from his adding, that what its effects might be in medicine had not been examined; but that its uſe in

* Von hüttenwerken, p. 597.

† White vitriol alſo is made at Goſlar, but by one citizen only, named Henni Balder. It is not procured by the evaporation of copper like other vitriol; but when large quantities of ore are roaſted in the furnaces, a red ſubſtance is from time to time collected on the refuſe of the ore, and found in ſome places half an ell thick. This ſubſtance, which is ſaltiſh, is formed into a lye, and boiled in ſmall leaden pans. The reſt of the proceſs I do not know, but I obſerved that it cryſtalliſes like ſaltpetre, but it is ſtronger and whiter. It is alſo caſt into ſmall cakes about the thickneſs of one's hand. This vitriol is employed by the leather-dreſſers, and may be uſed for many things inſtead of alum; but it cannot be uſed in dreſſing white ſkins, becauſe it makes them yellowiſh. *Hiſtoriſche nachricht*, p. 212.

making eye-water had been known almoſt as early as the time when it was diſcovered. This agrees with another account, according to which the method of boiling white vitriol was found out at the time when Chriſtopher Sander, whoſe ſervice to the Harz is well known, was tithe-gatherer *. Honemann ſays, that Sander was tithe-gatherer at the mines of the Upper Harz before the year 1564, but that in this year he was principal tithe-gatherer and director of the mines and melting-houſes at Goſlar †. Sander himſelf, in a paper dated Auguſt 3, 1575, ſeems to aſcribe the invention of white vitriol to duke Julius ‡.

At firſt this ſalt was called *erzalaun*, a name occaſioned by its likeneſs to cryſtal, but afterwards it was more frequently known by thoſe of *gallitzenſtein*, *golitzenſtein*, and *calitzenſtein* ||. The latter names however appear to be older than white vitriol itſelf; as we find that green vitriol, even before the year 1565, was called green *gallitzenſtein*. May not the word be derived from *gallæ*; becauſe it is probable that vitriol and galls were for a long time the principal articles uſed for making ink and

* Bruckmann, Magnalia Dei, ii. p. 459.

† Honemann, ii. p. 101. *Calvors Hiſtoriſche nachricht*, p. 161 and 225.

‡ Bruckmann, ii. p. 446.

|| In the like manner we find *calmey* inſtead of *galmey*.

in

in dyeing? I am of opinion that the white vitriol, which is produced in the mines of Rammelſberg in the form of icicles, gave riſe to the invention of this ſalt. The former, ſo early as the year 1565, was called white native vitriol, or white *gogkelgut*, and was packed up in caſks, and in that manner tranſported for ſale *. I ſhall not here enter into the old conjectures reſpecting the origin and component parts of this vitriol; but it deſerves to be remarked, that Henkel † and Neumann ‡ obſerved in it a mixture of zinc, by which Mr. Brandt, a member of the Swediſh council of the mines, was led to prove, that, when pure, it conſiſts of the vitriolic acid and zinc earth; and this was afterwards confirmed by Hellot ||.

* Calvor, Hiſtoriſche nachricht, p. 199 and 200. Properly it is written and pronounced *jöckel*. It is very remarkable that in Iceland this word at preſent ſignifies icicles. I imagined that I had been the firſt perſon who made this remark when I found the word often in *Olaſſen und Povelſen's Reiſe durch Iſland*, i. p. 46; but I obſerve that the ſame remark is made and explained by Anderſon, in *Nachrichten von Iſland*, Hamburg 1746, 8vo. p. 4.

† Kieshiſtorie, p. 904.

‡ Chemie, von Keſſel, iv. 2, p. 832, where may be found the old opinions on this ſubject.

|| Brandt, in Acta Upſalienſ. 1735. *Hellot in Memoires de l'Acad. des ſciences à Paris*, 1735, p. 29. Of the lateſt ſtate of white vitriol works I have given an account in *Beytragen zur ækonomie, technolog.* iv. p. 59. It deſerves to be remarked, that ſince the year 1730 the demand for this article has increaſed every ten years, though one cannot ſay why it is more uſed at preſent than formerly.

I come now, in the laſt place, to the hiſtory of this ſemi-metal, which, when furnace-calamine was uſed, could not remain long unobſerved, as it is ſometimes found amongſt it uncalcined in metallic drops. It is worthy of remark, that Albertus Magnus, who firſt deſcribed the uſe of furnace-calamine in making braſs, is the oldeſt author in which mention is to be found of zinc *. He calls it *marchaſita aurea*. This was properly a ſtone, the metallic particles of which were ſo entirely ſublimated by fire, that nothing but uſeleſs aſhes remained behind. It contained fixed quickſilver, communicated a colour to metals, on which account

* I ſhall here give the author's whole account, that the reader may compare it with my extract; for I am not ſo fully acquainted with the nomenclature of the ancient chemiſts as to flatter myſelf that I underſtand the whole of it.

De mineral. ii. cap. 11: Marchaſita, ſive marchaſida ut quidam dicunt, eſt lapis in ſubſtantia, et habet multas ſpecies, quare colorem accipit cujuſlibet metalli, et ſic dicitur marchaſita argentea et aurea, et ſic dicitur aliis. Metallum tamen quod colorat eum non diſtillat ab ipſo, ſed evaporat in ignem, et ſic relinquitur cinis inutilis, et hic lapis notus eſt apud alchimicos, et in multis locis veniuntur.

Lib. iii. cap. 10: Æs autem invenitur in venis lapidis, et quod eſt apud locum qui dicitur Goſelaria eſt puriſſimum et optimum, et toti ſubſtantiæ lapidis incorporatum, ita quod totus lapis eſt ſicut marchaſita aurea, et profundatum eſt melius ex eo quod purius.

Lib. v. cap. 5: Dicimus igitur quod marchaſita duplicem habet in ſui creatione ſubſtantiam, argenti vivi ſcilicet mortificati,

et

count it was well known to the alchemiſts, burned in the fire, and was at length entirely conſumed. It was found in various parts, but that at Goſlar was the beſt, becauſe the copper it contained ſeemed to have in it a mixture of gold. To give this copper however a ſtill greater reſemblance to gold, ſome tin was added to it, by which means it became more brittle. This marchaſita alſo rendered copper white as ſilver. Thus far Albertus. It obtained without doubt the name of *marchaſita aurea*, becauſe zinc communicates a yellow colour to copper; and for the ſame reaſon the Greeks and the Arabians called *cadmia* golden or *aurea* *. But how could Albertus ſay that marchaſite made copper white? Did he commit a miſtake and mean tin? To me this appears not improbable, as at one

et ad fixionem approximantis, et ſulphuris adurentis. Ipſam habere ſulphureitatem comperimus manifeſta experientia. Nam cum ſublimatur, ex illa emanat ſubſtantia ſulphurea manifeſta comburens. Et ſine ſublimatione ſimiliter perpenditur illius ſulphureitas.

Nam ſi ponatur ad ignitionem, non ſuſcipit illam priuſquam inflammatione ſulphuris inflámmetur, et ardeat. Ipſam vero argenti vivi ſubſtantiam manifeſtatur habere ſenſibiliter. Nam albedinem præſtat Veneri meri argenti, quemadmodum et ipſum argentum vivum, et colorem in ipſius ſublimatione cæleſtium præſtare, et luciditatem manifeſtam metallicam habere videmus, quæ certum reddunt artificem Alchimiæ, illam has ſubſtantias continere in radice ſua.

* Salmaſius de homonymis, p. 203.

time he ſeems to call it *argentea*. I imagine that he knew that copper, when mixed with as much zinc as poſſible, that is, according to Scheffer *, eighty-nine pounds to a hundred, became white; and it appears that by this he wiſhed to eſtabliſh its affinity with quickſilver.

The next author who gives an intelligible account of this metal, is Theophraſtus Paracelſus, who died in 1541. I do not however imagine that it was forgotten in this long interval, at leaſt by thoſe who were called alchemiſts. I am rather of opinion, that on account of the great hopes which it gave them by the colouring of copper, they deſcribed it purpoſely in an obſcure manner, and concealed it under other names, ſo that it was only not diſcovered in their works. There are few who would have patience to wade through theſe, and the few who could do ſo, turn their attention to objects of greater importance than thoſe which occupy mine. Gold and ſilver excepted, there is no metal which has had formerly ſo many and ſo wonderful names as zinc †. For this reaſon, chemiſts long believed that zinc was not a diſtinct ſemi-metal, but only a variety of tin or biſmuth; and with theſe perhaps it may hence have been often confounded.

* Chemiſche vorleſungen, p. 604.

† A great many may be found collected in *Fuchs, Geſchichte des zinks im verhalten gegen andere körper*. Erfurt 1778, 8vo.

The

The name zinc occurs firſt in Paracelſus. He expreſsly calls it a diſtinct metal, the nature of which was not ſufficiently known; which could be caſt, but was not malleable, and which was produced only in Carinthia. Was he then unacquainted with the zinc of Goſlar, which was known at an earlier period to Albertus Magnus *? George Agricola, who wrote about the year 1550, ſpeaks however of the Goſlar zinc, but he calls it *liquor candidus*, and German *conterfey* †. Matheſius,

* Paracelſi Opera, durch Briſgoium in truck gegeben. Straſburg 1616, fol. *Chronika des landes Karnten*, p. 251. *Von bergkrankheiten*, p. 656. *De ſeparatione elementorum*, p. 793. *Philoſophiæ* lib. iv. p. 56: Zinc for the moſt part is a baſtard kind of copper. *Primum manuale*, p. 685 and 686. *De mineralibus tractatus*, i. p. 137. Becauſe this is the principal paſſage, I ſhall here tranſcribe it as it may be found in the following edition: *Etliche Tractat. Theophr. Paracelſi.*—iv. *von Mineralien*, Straſburg 1582, 8vo. p. 425: Of zinc. There is another metal, zinc, which is in general unknown. It is a diſtinct metal of a different origin, though adulterated with many other metals. It can be melted, for it conſiſts of three fluid principles, but it is not malleable. In its colour it is unlike all others, and does not grow in the ſame manner; but with its *ultima materia* I am as yet unacquainted, for it is almoſt as ſtrange in its properties as *argentum vivum*. It admits of no mixture, will not bear the *fabricationes* of other metals, but keeps itſelf entirely to itſelf. In *Baſilii Valentini Triumph-wagen des antimonii*, Hamburg 1717, 8vo. p. 347, zinc is mentioned together with cobolt, marchaſite and biſmuth.

† De re metallica, lib. ix. p. 329, and in the firſt index. Liquor candidus primo e fornace defluens cum Goſelariæ excoquitur pyrites, *kobelt*, quem parietes fornacis exudant, *conterfey*.

who

who publiſhed his Sermons in 1562, ſays, "at Freyberg, there is red and white zinc *." Perhaps he did not mean the metal, but minerals that contained zinc. George Fabricius, who died in 1571, conjectures that *ſtibium* is what the miners call *cincum*, which can be melted, but not hammered †.

One ſees by theſe imperfect accounts that this ſemi-metal muſt have been ſcarce, even in the middle of the ſixteenth century, and that it was not in the collection of Agricola, which was conſiderable for that period. Libavius, who died in 1616, mentions it ſeveral times; but he regrets, in one of his letters, that he had not been able to procure any of it ‡. Was this owing to the prohibition of duke Julius, by which it was forbidden to be ſold? This prohibition is quoted by Pott || from *Jungii Mineralogia*, with which I am unacquainted; but as Pott has already, by his unintelligible quotations, made me ſpend many hours to no purpoſe, I ſhall not waſte more in ſearching for it. The prohibition alluded to is mentioned neither by Rehtmeier nor by any other author. The fooliſh taſte for alchemy, which

* In the third Sermon, p. 122.

† De metallicis rebus, in Geſner's work *De omni rerum foſſilium genere*, p. 27.

‡ This letter may be found in J. Hornung's *Cſta medica*. Lipſiæ 1661. iv.

|| De zinco, p. 21.

prevailed

prevailed then at the Duke's court, makes it not altogether improbable that one was iſſued *; and if that was really the caſe, it was occaſioned not ſo much by any dread of this ſemi-metal being miſuſed, as Pott thinks, but by the high hopes which were entertained of its utility in making gold. The firſt accurate and certain account of the method of procuring zinc at Goſlar, is, as far as I know, given by Lohneyſs, though he conſiders it to be the ſame as biſmuth †. Joh. Schrœder of Weſtphalia,

* How much duke Julius, who in other reſpects did great ſervice to his country, ſuffered himſelf to be duped by the art of making gold, appears from an anecdote given by Rehtmeier, p. 1016. Of this anecdote I received from Mr. Ribbentrop an old account in manuſcript, which one cannot read without aſtoniſhment. There is ſtill ſhewn, at the caſtle of Wolfenbuttle, an iron ſtool, on which the impoſtor, Anna Maria Zieglerinn, named *Schluter Ilſche*, was burnt, February 5, 1575.

† Page 83: When the people at the melting-houſes are employed in melting, there is formed under the furnace, in the crevices of the wall, among the ſtones where it is not well plaſtered, a metal which is called zinc or *conterfeht*; and when the wall is ſcraped, the metal falls down into a trough placed to receive it. This metal has a great reſemblance to tin, but it is harder and leſs malleable, and rings like a ſmall bell. It could be made alſo, if people would give themſelves the trouble; but it is not much valued, and the ſervants and workmen only collect it when they are promiſed drink-money. They, however, ſcrape off more of it at one time than at another; for ſometimes they collect two pounds, but at others not above two ounces. This metal, by itſelf, is of no uſe, as, like biſmuth, it is not malleable; but when mixed

phalia, who died in 1664, calls it *marcaſita pallida* *.

The firſt perſon who purpoſely procured this ſemi-metal from calamine, by the addition of ſome inflammable ſubſtance, was undoubtedly Henkel, who gave an account of his ſucceſs in the year 1741, though he concealed the whole proceſs †. After him, Dr. Iſaac Lawſon, a Scotſman, ſeems to have made experiments, which proved the poſſibility of obtaining zinc, in this manner, on a large ſcale; and in 1737 Henkel heard that it was then manufactured in England with great advantage. Of this Lawſon I know nothing more than what is related by Dr. Watſon ‡. Anthony von Swab, member of the Swediſh

mixed with tin it renders it harder and more beautiful, like the Engliſh tin. This zinc or biſmuth is in great requeſt among the alchemiſts.

* Theſaurus pharmacolog. Ulmæ 1662, 4to. p. 458.

† Kieshiſtorie, p. 571, and particularly p. 721.

‡ Pott refers to Lawſon's *Diſſert. de nihilo*, and quotes ſome words from it; but I cannot find it; nor am I ſurpriſed at this, as it was not known to Dr. Watſon. See *Chemical Eſſays*; Cambridge 1786, 12mo. iv. p. 34. Pryce, in *Mineral. Cornub.* p. 49. ſays: "The late Dr. J. Lawſon, obſerving that the flowers of lapis calaminaris were the ſame as thoſe of zinc, and that its effects on copper were alſo the ſame with that ſemi-metal, never remitted his endeavours till he found the method of ſeparating pure zinc from that ore. The ſame account is given in the ſupplement

Swediſh council of mines, procured this ſemi-metal afterwards from calamine by diſtillation, in 1742; as did Marggraf in 1746, who appears, however, not to have been acquainted with the Swediſh experiment. In the year 1743, one Champion eſtabliſhed tin-works at Briſtol, which were continued by his ſucceſſor James Emerſon, who eſtabliſhed works of the like kind at Henham, in the neighbourhood. The manner in which the metal was procured has been deſcribed by Dr. Watſon, in his Chemical Eſſays.

The greater part of this ſemi-metal, uſed in Europe, is undoubtedly brought from the Eaſt Indies. The Commercial Company in the Netherlands, between the years 1775 and 1779, cauſed to be ſold, on their account, above 943,081 pounds of it *. In the year 1780, the chamber of Rotterdam alone ſold 28,000 pounds; and I find, by printed catalogues, that the other chambers, at that period, had not any of it in their poſſeſſion. If the account given by Raynal be true, the Dutch Eaſt India Company purchaſe annually, at Palimbang, a million and a half of

ſupplement to Chambers's Dictionary, 1753, art. *calam.* and *zinc*; and in *Campbell's Political Survey of Britain*, ii. p. 35. The latter, however, adds, that Lawſon died too early to derive any benefit from his diſcovery.

* Ricards Handbuch der kaufleute, i. p. 57.

pounds.

pounds *. In 1781, the Daniſh Company, at Copenhagen, purchaſed 153,953 pounds of tutenage, which had been carried thither in two veſſels, at the rate of from four and one-eighth to four and a quarter ſchillings Lubec per pound. It is probable that the Engliſh and Swedes import this article alſo. It would be of ſome conſequence, if one could learn in what part of India, when, and in what manner this ſemi-metal was firſt procured, and in what year it was firſt carried thence to Europe. According to the ſcanty information which we have on the ſubject, it comes from China †, Bengal ‡, Malacca ||, and the Malabar coaſt, from which copper and tin are alſo imported §. In the oldeſt bills of lading of ſhips belonging to the Ne-

* Geſchichte der beſitzungen in Indien, i. p. 241. The author ſays that the Company give for it at the rate of twenty-eight florins three-quarters per hundred weight, and that this price is moderate. At Amſterdam, however, the price commonly is from ſeventeen to eighteen florins banco. According to a catalogue which I have in my poſſeſſion, the price, on the 9th of May 1788, was ſeventeen florins, and, on the 22d of January 1781, it was only ſixteen.

† Meiſters Orient. luſtgärtner, p. 276.

‡ Ibid. p. 268.

|| Linſchoten's Reiſe, b. ii. c. 17. The author calls it *calaem*, the name uſed in the country. It is a kind of tin. *Bruckmann, Magnal. Dei*, p. 1038.

§ Baldæus, Beſchreibung der küſte Malabar, Amſterd. 1672. fol. p. 98.

therlands

therlands I find no mention of zinc; but it is poſſible that it may be comprehended under the name of Indian tin; for ſo it was at firſt called. Savot, who died about the year 1640, relates, on the authority of a cotemporary writer *, that ſome years before † the Dutch had taken from the Portugueſe a ſhip laden with this metal, which was ſold under the name of *ſpeautre*. It is probable, therefore, that it was brought to Europe ſo early as the beginning of the ſeventeenth century. Indian tin is mentioned by Mr. Boyle ‡.

It is probable that this ſemi-metal was diſcovered in India before any thing of the European zinc had been known in that country; but we are ſtill leſs acquainted with the cauſe of the diſcovery than with the method of procuring the metal. We are told that an Engliſhman, who, in that century, went to India, in order to diſcover the proceſs uſed there, returned with an account that it was obtained by diſtillation *per deſcenſum* §.

* De nummis antiquis; in Theſaurus antiquitat. Roman. xi. p. 1195.

† In the lateſt edition of Eſſays de Jean Rey, publiſhed, with notes, by Gobet, Paris 1777, viii. p. 178. It is there ſaid that this happened in the year 1620.

‡ Experimenta de flammæ ponderabilitate. Londini 1673. 12mo. p. 15. exp. 12.

§ Bergmann, Opuſcula, ii. p. 321. *Abhandlungen der Schwed. Akad.* xxxvii. p. 85.

Reſpecting the origin of the different names of this ſemi-metal, I can offer very little. *Conterfey* ſignified formerly every kind of metal made in imitation of gold *. Friſch ſays it was called *zink*, from which was formed firſt *zinetum*, and afterwards *zincum*, becauſe the furnace-calamine aſſumes the figure of (*zinken* or *zacken*) nails or ſpikes; but it is to be remarked, that theſe names do not occur before the diſcovery of this ſemi-metal, though *ofenbruch* was known long before. Fulda ſpeaks of the Anglo-Saxon *ſin*, *zink*, which he tranſlates *obryzum* †. *Spiauter*, *ſpeauter*, and *ſpialter*, from which Boyle made *ſpeltrum*, and alſo *tutaneg* or *tuttanego*, came to us from India with the commodity. Under the laſt-mentioned name is ſometimes comprehended a mixture of tin and biſmuth. *Calaem* is alſo an Indian appellation given to this ſemi-metal, and has a conſiderable likeneſs to calamine; but I am of opinion with

* Matthefius, Pred. v. p. 250. "*Conterfeil* is a metal of little value, formed by additions and colouring ſubſtances, ſo that it reſembles gold or ſilver, as an image, or any thing counterfeited. does its archetype. Thus copper is coloured by calamine and other mixtures, in ſuch a manner that it appears to be pure gold." In the police ordinance iſſued at Straſburgh in 1628, young women are forbidden to wear gold or ſilver, or any *conterfaite*, and every thing that might have the appearance of gold or ſilver.

† Sammlung Germaniſcher würzelwörter. Halle 1776. 4to. p. 285.

Saumaiſe,

Saumaiſe, that the latter is not derived from the former, as *lapis calaminaris* occurs in the thirteenth century, and *calaem* was firſt brought to us by the Portugueſe from India.

BOOK-CENSORS.

"ON account of the great eaſe," ſays Mr. Putter, "with which, after the invention of printing, copies of books could be multiplied and diſperſed, it was neceſſary that ſome means ſhould be deviſed to prevent a bad uſe from being made of this art, and to guard againſt its being employed to the prejudice of either religion or good morals, or to the injury of ſtates. For this reaſon it was every where laid down as a general maxim, that no one ſhould be allowed to eſtabliſh a printing-office at pleaſure, but by the permiſſion and under the inſpection of government; and that no work ſhould be ſuffered to go to preſs until it had been examined by a cenſor appointed for that purpoſe, or declared by a particular order to be of a harmleſs nature *."

* Der büchernachdruck nach ächten grundſätzen des rechts geprüft. 1774, 4to. It was by reading the above paſſage I was induced to make this inquiry into the antiquity of book-cenſors.

Many centuries, however, before the invention of printing, books were forbidden by different governments, and even condemned to the flames. A variety of proofs can be produced that this was the caſe among both the ancient Greeks and Romans. At Athens the works of Protagoras were prohibited; and all the copies of them which could be collected were burnt by the public crier *. At Rome the writings of Numa, which had been found in his grave, were, by order of the Senate, condemned to the fire, becauſe they were contrary to the religion which he had introduced †. As the populace at Rome were, in times of public calamity, more addicted to ſuperſtition than ſeemed proper to the government, an order was iſſued that all ſuperſtitious and aſtrological books ſhould be delivered into the hands of the prætor ‡. This order was often repeated §; and the emperor Auguſtus cauſed more than twenty thouſand of theſe books to be burnt at one time ||. Under the

* Diogenes Laert. lib. ix. 52. *Cicero De nat. deor.* lib. i. cap. 23. *Lactantius De ira*, ix. 2. *Euſebius De præparatione evang.* xiv. p. 19. *Minucius Felix*, viii. 13.

† Livius, lib. xl. c. 29. *Plin.* xiii. 13. *Plutarchus in Vitæ Numæ. Lactantius De falſa relig.* i. 25, 5. *Valer. Max.* i. cap. 1, 12.

‡ Livius, lib. xxv. cap. 1.

§ Liv. xxxix. 16. *Tacit. Annal.* vi. 12.

|| Sueton. lib. ii. cap. 31.

fame

ſame emperor the ſatirical works of Labienus were condemned to the fire, which was the firſt inſtance of this nature; and it is related as ſomething ſingular, that, a few years after, the writings of the perſon who had been the cauſe of the order for that purpoſe ſhared the like fate, and were alſo publicly burnt *. In a manner ſomewhat ſimilar the works of Ben. Arias Montanus, who aſſiſted to make the firſt catalogue of prohibited books in the Netherlands, were afterwards inſerted in a catalogue of the ſame kind. The burning of theſe works having induced Caſſius Severus to ſay, in a ſneering manner, that it would be neceſſary to

* The whole circumſtance is related by Seneca the rhetorician, in the introduction to the fifth, or, as others reckon, the tenth book of his *Controverſiæ*, or that which ſtands before *Controverſ.* xxx. Every one, perhaps, may not be aware that theſe *Controverſiæ* are not to be found in all the editions of the works of that philoſopher. In *Senecæ rhetoris Suaſoriæ, controverſiæ, declamationumque excerpta*, Pariſiis 1613, fol. an edition valuable on account of the annotations, the paſſage occurs in page 197: —In hunc (Labienum) primum excogitata eſt nova pœna; effectum eſt enim per inimicos, ut omnes ejus libri incenderentur. Res nova et inſueta, ſupplicia de ſtudiis ſumi. Bono hercule publico, iſta in pœnas ingenioſa crudelitas poſt Ciceronem inventa eſt. Quid enim futurum fuit, ſi ingenium Ciceronis triumviris libuiſſet proſcribere? - - - - - Ejus, qui hanc in ſcripta Labieni ſententiam dixerat, poſtea viventis adhuc ſcripta combuſta ſunt; jam non malo exemplo quia ſuo - - - - Caſſii Severi, hominis Labieno junctiſſimi, belle dicta res ferebatur. Illo tempore quo libri Labieni ex S. C. urebantur: Nunc me, inquit, vivum uri oportet, qui illos edidici.

burn him alive, as he had got by heart the writings of his friend Labienus, this expreſſion gave riſe to a law of Auguſtus againſt abuſive writings *. When Cremutius Cordus, in his Hiſtory, called C. Caſſius the laſt of the Romans, the Senate, in order to flatter Tiberius, cauſed the book to be burnt; but a number of copies were ſaved by being concealed †. Antiochus Epiphanes cauſed the books of the Jews to be burnt ‡; and in the firſt centuries of our æra the books of the Chriſtians were treated with equal ſeverity, of which Arnobius bitterly complains §. We are told by Euſebius, that Diocletian cauſed the ſacred Scrip-

* Taciti Annal. lib. i. c. 72. Bayle, in his Dictionary, has endeavoured to clear up ſome doubts reſpecting the hiſtory of Caſſius and Labienus. See the article Caſſius.

† Libros per ædiles cremandos cenſuere patres, ſed manſerunt occulti et editi. Quo magis ſocordiam eorum inridere libet, qui præſenti potentia credunt extingui poſſe etiam ſequentis ævi memoriam. Nam contra, punitis ingeniis gliſcit auctoritas; neque aliud externi reges, aut qui eadem ſævitia uſi ſunt, niſi dedecus ſibi, atque illis gloriam peperere. *Tacit. Annal.* lib. iv. cap. 35.

‡ Maccab. ii.

§ Alios audio muſſitare indignanter et dicere: oportere ſtatui per ſenatum, aboleantur ut hæc ſcripta, quibus Chriſtiana religio comprobetur, et vetuſtatis opprimatur auctoritas - - - Nam intercipere ſcripta, et publicatam velle ſubmergere lectionem, non eſt deos defendere, ſed veritatis teſtificationem timere. *Arnobius Adverſus gentes*, lib. iii. Lugduni Bat. 1651. 4to. p. 104. He repeats the ſame thing at the end of the fourth book, p. 152.

tures

tures to be burnt *. After the ſpreading of the Chriſtian religion the clergy exerciſed againſt books that were either unfavourable or diſagreeable to them, the ſame ſeverity which they had cenſured in the heathens as fooliſh and prejudicial to their own cauſe. Thus were the writings of Arius condemned to the flames at the council of Nice; and Conſtantine threatened with the puniſhment of death thoſe who ſhould conceal them †. The clergy aſſembled at the council of Epheſus requeſted the Emperor Theodoſius II. to cauſe the works of Neſtorius to be burnt; and this deſire was complied with ‡. The writings of Eutyches ſhared the like fate at the council of Chalcedon; and it would not be difficult to collect examples of the ſame kind from each of the following centuries.

We have inſtances alſo that, many centuries

* Euſebius, Hiſtor. eccleſ. lib. viii. cap. 2. Suidas ſays the ſame.

† Socrates, lib. i. cap. 6.

‡ Ulpianus: Tantundem debebit judex facere in libris improbatæ lectionis, magicis forte, vel his ſimilibus; hæc enim omnia protinus corrumpenda ſunt. *Digeſtor.* lib. x. tit. 2, 4, 1. - - - Nec vero impios libros nefandi et ſacrilegi Neſtorii adverſus venerabilem orthodoxorum ſectam, decretaque ſanctiſſimi cœtus antiſtitum Epheſi habiti, ſcriptos, habere aut legere, aut deſcribere quiſquam audeat, quos diligenti ſtudio requiri, ac publice comburi decernimus - - - *Cod.* lib. i. tit. 5, 6.

prior to the invention of printing, authors ſubmitted their works, before they were publiſhed, to the judgment of their ſuperiors. This was done principally by the clergy; partly to ſecure themſelves from cenſure or puniſhment, and partly to ſhew their reſpect to the Pope or to biſhops. It, however, does not appear that this was a duty, but a voluntary act. In the year 768 Ambroſius Autpert, a Benedictine monk, ſent his Expoſition of the book of Revelation to Pope Stephen III, and begged that he would publiſh the work and make it known. On this occaſion he ſays expreſsly, that he is the firſt writer who ever requeſted ſuch a favour; that liberty to write belongs to every one who does not wiſh to depart from the doctrine of the fathers of the church; and he hopes that this freedom will not be leſſened on account of his voluntary ſubmiſſion *.

Soon after the invention of printing, laws began to be made for ſubjecting books to examination; a regulation propoſed even by Plato; and which has been wiſhed for by many ſince †. It is very probable

* Sed non ideo libertas ſuccubuit, quia humilitas ſemetipſam libere proſtravit. *Baillet, Jugemens des Sçavans.* Paris 1722. 4to. vol. i. p. 26.

† In the year 1480 Hermolaus Barbarus wrote to George Merula as follows: Plato, in Inſtitutione de legibus, inter prima comme-

probable that the fear under which the clergy were, leſt publications ſhould get abroad prejudicial to religion, and conſequently to their power, contributed not a little to haſten the eſtabliſhment of book-cenſors. The earlieſt inſtance of a book printed with a permiſſion from government, is commonly ſuppoſed to occur in the year 1480; and Dom Liron, a Benedictine monk, is, perhaps, the firſt perſon who made that remark. He is the author of a work called *Singularités hiſtoriques et litteraires* * ; in the laſt part of which, where he ſpeaks of the Heidelberg edition of the book *Noſce te ipſum*, in 1480, he ſays, "This is the firſt publication I found accompanied with ſeveral ſolemn "approbations and atteſtations in its favour." The ſame thing is ſaid by J. N. Weiſlinger, one of the moſt illiberal defenders of the Catholic church, in whoſe work, entitled *Armamentarium*

commemorat, in omni republica præſcribi curarive oportere, ne cui liceat, quæ compoſuerit, aut privatim oſtendere, aut in uſum publicum edere, antequam ea conſtituti ſuper id judices viderint, nec damnarint. Utinam hodieque haberetur hæc lex; neque enim tam multi ſcriberent, neque tam pauci bonas litteras diſcerent. Nam et copia malorum librorum offundimur, et omiſſis eminentiſſimis auctoribus, plebeios et minutulos conſectamur. Et quod calamitoſiſſimum eſt, periti juxta imperitique de ſtudiis impune ac promiſcue judicant.—This letter may be found in *Angeli Politiani Opera*. Lugduni 1533. 8vo. p. 441.

* Singularités hiſtoriques et litteraires. Paris 1738—1740. 4to. vol. viii.

Catholicum,

Catholicum *, there is an account of that book. He there tells us in Latin, without mentioning Liron: *Hic primus liber eſt, quem ego vidi, theologorum examini ſubjectum, lectum et approbatum*; and, in the opinion of Mercier, it really is the oldeſt. It has four approbations; the firſt and laſt of which I ſhall here inſert, as they will ſerve to ſhew the fooliſh pride of the clergy at that period:—"Ego Philippus Rota, juris utriuſque doctor, *licet omnium minimus*, hoc ipſum opuſculum *Noſce te* inſtructius perlegi ac diligentius perſcrutatus ſum. Et quoniam ipſum non modo ſancte catholiceque compoſitum reperi, verum etiam mira utilitate refertiſſimum, in hujuſce rei teſtimonium me ſubſcribere non dubitavi. - - - - - Nos Mapheus Girardo, *miſeratione divina* patriarcha Venetiarum, Dalmatiaeque primas, ex inſpectione ſupraſcriptorum dominorum, qui fidem faciunt de ſupraſcripto opere, et ex tali ſua concluſione et fide conjuncti, idem teſtificamur eſſe opus orthodoxum et devotum †."

There

* Armamentarium catholicum bibliothecæ quæ aſſervatur Argentorati in commenda St. Johannis Hieroſolymitani. Argentinæ 1749. fol.

† I Philip Rota, doctor of laws, *though the leaſt of all*, have read over carefully, and diligently examined, this ſmall work, *Noſce te*; and as I have found it not only compoſed devoutly and catholically, but abounding alſo with matter of wonderful utility, I do not heſitate, in teſtimony of the above, to ſubſcribe my name - - - - I Mapheus Girardo, by the divine mercy

There were, therefore, cenſors at this early period who gave their opinion of books without reading them.

I ſhould have conſidered theſe inſtances as the oldeſt information reſpecting book-cenſors, had I not been induced by Mr. Eccard, the learned amanuenſis belonging to our library, to look into the *Literary Weekly Journal of Cologne*, for the year 1778. In that work I found an ingenious account, by an anonymous author, of the early ſtate of printing in that city, and of two books printed almoſt a year ſooner than 1479, with the approbation of the public cenſor. The firſt is *Wilhelmi epiſcopi Lugdunenſis Summa de virtutibus*; at the end of which are the following words:—"Benedictus ſit dominus virtutum, qui hoc opus earundem felici conſummatione terminari dedit in laudabili civitate Colonienſi, temptatum, *admiſſumque et approbatum ab alma univerſitate ſtudii* civitatis praedictae, *de conſenſu et voluntate* ſpectabilis et egregii viri pro tempore rectoris ejuſdem, impreſſum per Henr. Quentel." The other book is a Bible, with the following concluſion:—"Anno incarnationis dominice milleſimo quadringenteſimo LXXIX ipſa

mercy patriarch of Venice and primate of Dalmatia, confiding in the fidelity of the above gentlemen, who have examined and approved the above-mentioned book, do teſtify that it is a devout and orthodox work.

vigilia Matthaei apoſtoli. Quando inſigne veteris novique teſtamenti opus cum canonibus evangeliſtarum et eorum concordantiis in laudem et gloriam ſancte et individue trinitatis intemerateque virginis Marie impreſſum in civitate Colonienſi per Conradum de Homborch, *admiſſum, approbatum* ab alma univerſitate Colonienſi."

The oldeſt mandate for appointing a book-cenſor is, as far as I know at preſent, that iſſued by Berthold, archbiſhop of Mentz, in the year 1486, and which may be found in the fourth volume of Guden's *Codex diplomaticus* *. As this curious work is not common, ſome readers, perhaps, will not be diſpleaſed to ſee this order at full length, with the inſtructions given to the cenſors.

MANDATUM POEN. DE CODICIBUS GRAECIS, LATINIS &c. IN LINGUAM VULGAREM SINE PRAEVIA DOCTORUM APPROBATIONE NON VERTENDIS &c. 1486.

BERTOLDUS D. G. ſancte Moguntine Sedis Archiepiſcopus S. R. I. per Germaniam Archicancellarius, princeps Elector. Etſi ad mortalem eruditionem comparandam, divina quadam imprimendi arte ad ſingularum ſcientiarum codices

* Codex diplomaticus. Francof. et Lipſ. 1758. 4to. vol. iv. p. 460. An account of the eſtabliſhment of a book-cenſor at Mentz may be found alſo in *Georg. Chriſt. Johannis Rerum Moguntiacarum* vol. i. fol. p. 798.

abunde facilique perveniri poſſit, compertum tamen habemus, quoſdam homines, inanis glorie aut pecunie cupiditate ductos, hac arte abuti, et quod ad vite hominum inſtitutionem datum eſt, ad perniciem et calumpniam deduci.

Vidimus enim libros de divinis officiis et apicibus Religionis noſtre e latina in germanicam linguam traductos, non ſine religionis dedecore verſari per manus vulgi; Quid denique de ſacrorum Canonum legumque preceptis? Que, etſi a iure conſultis, viris utrique prudentiſſimis atque eloquentiſſimis, aptiſſime limatiſſimeque ſcripta ſint, tantam tamen Scientia ipſa habet nodoſitatem, ut etiam eloquentiſſimi ſapientiſſimique hominis extrema vix ſufficiat etas.

Huius artis volumina ſtulti quidam, temerarii atque indocti, in vulgarem linguam traducere audent, quorum traductione, multi etiam docti Viri videntes confeſſi ſunt, ſe propter maximam verborum impropriationem et abuſum minus intellexiſſe. Quid denique dicendum de reliquarum ſcientiarum operibus, quibus etiam nonunquam falſa commiſcent, aut falſis Titulis inſcribunt, tribuuntque Authoribus egregiis eorum figmenta, quo magis emptores inveniant?

Dicant tranſlatores tales, ſi verum colunt, bono etiam

etiam ſive malo id faciant animo, anne lingua Germanica capax ſit eorum, que tum Greci, tum Latini egregii Scriptores de ſummis ſpeculationibus Religionis Xpiane et rerum ſcientia accuratiſſime argutiſſimeque ſcripſerunt? Fateri oportet, ydiomatis noſtri inopiam minime ſufficere, neceſſeque fore, eos ex ſuis cervicibus nomina rebus fingere incognita; aut, ſi veteribus quibuſdam utantur, veritatis ſenſum corrumpere, quod propter magnitudinem periculi in litteris ſacris magis veremur. Quis enim dabit rudibus atque indoctis hominibus, et femineo ſexui, in quorum manibus Codices ſacrarum litterarum inciderint, veros excerpere intellectus? Videatur ſacri Ewangelii, aut Epiſtolarum Pauli textus, nemo ſane prudens negabit, multa ſuppletione et ſubauditione aliarum ſcripturarum opus eſſe.

Occurrerunt hec, quia vulgatiſſima ſunt. Quid putabimus de his, que inter ſcriptores in eccleſia Catholica ſub accerrima pendent diſpoſitione? Multa afferre poſſemus, de quibus tamen ad propoſitum paucula oſtendiſſe ſufficiat.

Verum, cum initium huius artis in hac aurea noſtra Moguntia, ut vera ejus appellatione utamur, divinitus emerſerit, hodieque in ea politiſſima atque emendatiſſima perſeveret; Iuſtiſſime eius artis decus a nobis defenſabitur; Noſtra enim interſit, divi-

divinarum litterarum puritatem immaculatam ſervari; Vnde prefatis erroribus, et hominum impudentium aut ſceleratorum auſibus, prout poſſumus, auctore Domino cuius res agitur, occurrere, frenoque cohibere volentes, omnibus et ſingulis eccleſiaſticis et ſecularibus perſonis noſtre ditioni ſubjectis, aut infra eius terminos negotiantibus, cuiuſcunque gradus, ordinis, profeſſionis, dignitatis aut conditionis exiſtant, tenore preſentium diſtricte precipiendo mandamus, ne aliqua opera, cuiuſcunque ſcientie, artis vel notitie, e Greco, Latino, vel alio ſermone, in vulgare Germanicum traducant, aut traducta, quovis commutationis genere vel titulos diſtrahant, vel comparent, publice vel occulte, directe vel indirecte, niſi ante impreſſionem, et impreſſa ante diſtractionem, per clariſſimos honorabileſque, nobis dilectos, Doctores et Magiſtros univerſitatis ſtudii in civitate noſtra Moguntina Iohannem Bertram de Nuenburg in Theologia, Alexandrum Diethrich in iure, Theodericum de Meſchede in medicina, et Alexandrum Eler in artibus, Magiſtros et Doctores Vniverſitatis ſtudii in opido noſtro Erfordie ad hoc deputatos, patenti teſtimonio, ad imprimendum vel diſtrahendum admiſſa vel, ſi in opido Franckfordie—libri venales expoſiti, per honorabilem, devotum nobis dilectum loci plebanum in Theologia magiſtrum, ac unum vel duos Doctores et Licentiatos, per Conſulatum dicti Opidi, annali ſtipendio conductos, viſi et approbati fuerint.

Si

Si quis vero huius noſtre proviſionis contemptor fuerit, aut contra huiusmodi mandatum noſtrum conſilium auxilium vel favorem quovis modo, directe vel indirecte, preſtiterit, Sententiam excommunicationis ipſo facto, et preterea amiſſionem librorum expoſitorum, ac etiam Centum florenorum auri penam, Camere noſtre applicandam, ſe noverit incurriſſe; a qua ſententia nemini, citra auctoritatem ſpecificam, liceat abſolvere.

Datum apud Arcem S. Martini in civitate noſtra Moguntina, noſtro ſub Sigillo.

Die quarta menſis Ianuarii Anno

MCCCCLXXXVI.

EIUSDEM CUM PRIORI MANDATO ARGUMENTI QUOAD EXACTAM LIBRORUM CENSURAM. 1486.

BERTOLDUS (&c.) Honorabilibus, Doctiſſimis nobis in Xpo dilectis, Io. Bertram in Theologia, AL. Dietherich in Iure, TH. de Meſchede in Medicina, Doctoribus, et AND. Eler in Artibus Magiſtro—Salutem, et ad infra ſcripta diligentiam.

Experti ſcandala et fraudes, per quoſdam Litterarum tranſlatores ac impreſſores librorum commiſſas, hiſque obviare, et viam ut poſſumus occludere cupientes; mandamus ne quis ſub dioceſi et ditione noſtra quos libros in germanicam linguam transferat, imprimat, vel impreſſos diſtrahat, niſi prius

prius in Civitate noſtra Moguntina talia Opera ſive libri per vos viſi, et quantum ad materiam ipſam, ad transferendum et diſtrahendum probati fuerint, iuxta formam mandati deſuper publicati.

Vobis igitur, de quorum prudentia et circumſpectione plurimum confidimus, tenore preſentium committimus, ut, ſi quando transferenda, imprimenda vel diſtrahenda Opera ſive libri ad vos delati fuerint, eorum materiam ponderetis, et ſi forte ad rectum ſenſum non facile traduci poterunt, aut errores et ſcandala magis pariunt, aut pudicitiam ledunt, eos reiiciatis; quos vero admittendos ſtatueritis, manibus veſtris propriis, ſaltem duo ex vobis in fine ſignetis, quo magis appareat, qui libri per vos viſi et probati fuerint. Deo noſtro ac rei publice munus gratum utileque exhibituri.

Data apud Arcem S. Martini—Sub ſecreto noſtro.
X Ianuarii Anno MCCCCLXXXVI.

In the year 1501, pope Alexander VI publiſhed a bull, the firſt part of which may form an excellent companion to the above mandate of the archbiſhop of Mentz *. After ſome complaints againſt the devil, who ſows tares among the wheat, his

* The whole bull may be ſeen in *Annales eccleſiaſtici ab anno quo deſinit Baronius uſque ad an.* 1534, *auctore Odorico Raynaldo*, tom. xix. Coloniæ Agrip. 1691, fol. p. 514. ad an. 1501. § 36.

holineſs proceeds thus: "Having been informed, that by means of the ſaid art many books and treatiſes containing various errors and pernicious doctrines, even hoſtile to the holy Chriſtian religion, have been printed, and are ſtill printed in various parts of the world, particularly in the provinces of Cologne, Mentz, Triers, and Magdeburg; and being deſirous, without further delay, to put a ſtop to this deteſtable evil - - - - - - we, by theſe preſents, and by authority of the Apoſtolic chamber, ſtrictly forbid all printers, their ſervants, and thoſe exerciſing the art of printing under them, in any manner whatſoever, in the aboveſaid provinces, under pain of excommunication, and a pecuniary fine, to be impoſed and exacted by our venerable brethren the archbiſhops of Cologne, Mentz, Triers, and Magdeburg, and their vicars general or official in ſpirituals, according to the pleaſure of each in his own province, to print hereafter any books, treatiſes, or writings, until they have conſulted on this ſubject the archbiſhops, vicars or officials above mentioned, and obtained their ſpecial and expreſs licence, to be granted free of all expence, whoſe conſciences we charge, that before they grant any licence of this kind, they will carefully examine, or cauſe to be examined, by able and catholic perſons, the works to be printed; and that they will take the utmoſt care that nothing may be printed wicked and ſcandalous, or contrary to the orthodox faith." - - - The

reſt

reſt of the bull contains regulations to prevent works already printed from doing miſchief. All catalogues and books printed before that period were to be examined, and thoſe which contained any thing prejudicial to the Catholic religion were to be burned.

In the beginning of the ſixteenth century, it was ordered by the well-known council of the Lateran, held at Rome in the year 1515, that in future no books ſhould be printed but ſuch as had been inſpected by eccleſiaſtical cenſors. The following are the words of the decree: Sacro approbante concilio ſtatuimus et ordinamus, quod de caetero nullus librum aliquem, ſive aliam quamcunque ſcripturam tam in urbe noſtra quam in aliis civitatibus et dioceſibus imprimere ſeu imprimi facere praeſumat, niſi prius in urbe per vicarium noſtrum et ſacri palatii magiſtrum, in aliis vero dioceſibus per epiſcopum vel alium ab epiſcopo ad id deputandum et inquiſitorem haereticae pravitatis illius dioeceſis in quibus librorum impreſſio eiuſmodi fieret, diligenter examinetur, et per horum manu propria ſubſcriptionem *gratis et ſine dilatione* imponendam approbetur. Qui autem ſecus praeſumpſerit, ultra librorum amiſſionem, et illorum publicam combuſtionem, excommunicationis ſententia innodatus exiſtat *.

* Summa conciliorum, a Bartholemeo Caranza collecta, et Franciſci Sylvii additionibus aucta. Duaci 1659. 8vo. p. 670.

In France, the faculty of Theology uſurped, as ſome ſay, the right of cenſuring books; but in the year 1650, when public cenſors were appointed without their conſent, whom the faculty oppoſed, they ſtated the antiquity of their right to be two hundred years. For they ſaid, "It is above two "hundred years ſince the doctors of Paris have had "a right to approve books without being ſubject-"ed but to their own faculty, to which they aſſert "they are alone reſponſible for their deciſions †."

EXCLUSIVE PRIVILEGE FOR PRINTING BOOKS.

I DO not mean in this article to give a complete catalogue of all the books printed under a privilege in the fifteenth and ſixteenth centuries, for ſuch a liſt would be attended with very little utility. All I wiſh is to contribute ſomething towards anſwering the queſtion, What are the oldeſt privileges granted to books?

The oldeſt known at preſent, is that granted in the year 1490, by Henry biſhop of Bamberg, to the following book: *Liber miſſalis ſecundum ordinem eccleſiae Bambergenſis*—Anno incarnationis dominice

† Baillet, Jugemens des ſçavans, i. p. 19.

MCCCCXC. nono vero kal. April.—In civitate Babenbergn. per magiſtrum Johannem Senſenſchmidt, prefate civitatis incolam, et Heinr. Petzenſteiner. This privilege was firſt noticed by Mr. Panzer, in his Hiſtory of the Nuremberg editions of the Bible *, and afterwards by Mr. Am Ende, in Meuſel's Collections for enlarging hiſtorical knowledge †. The latter ſays: "One may readily believe that this biſhop was not the inventor of ſuch privileges, and that they are conſequently of much greater antiquity than has hitherto been ſuppoſed." Mr. Am Ende mentions alſo a privilege of the year 1491, to a work called *Hortus ſanitatis*, typis Iacobi Meydenbach. - - - - - Impreſſum autem eſt hoc ipſum in incl. civ. Moguntina - - - ſub Archipraeſulatu rever. et benigniſſ. principis et D. D. Bertholdi, archiep. Moguntinenſis ac princ. elector. cujus feliciſſimo auſpicio graditur, recipitur et auctoriſatur. This, ſays Mr. Am Ende, may allude to a privilege, and perhaps not. For my part, I conjecture that it refers only to a permiſſion to print, granted in conſequence of the inſtitution of book-cenſors by the archbiſhop Berthold, in the year 1486.

The oldeſt Venetian privilege at preſent known,

* Geſchichte der Nürnbergiſchen auſgaben der Bibel. Nurnberg 1778, 4to. p. 31.

† Meuſel, Beytragen zur erweiterung der geſchichtkunde, part ii, p. 105.

is of the year 1491, found by Mr. Putter to the following work: *Foenix Magiſtri Petri memoriae Ravennatis.* At the end ſtands, Bernardinus de Choris de Cremona impreſſor delectus impreſſit. Venetias die X Ianuarii MCCCCXCI. The book is in quarto, and has the privilege on both the laſt pages. There is a Venetian privilege alſo of the year 1492, to *Tragedie Senece cum commento* - - - - Cum privilegio ne quis audeat hoc opus cum hoc commento imprimere, ſub pena in eo contenta, Venetiis per Lazarum Iſſarda de Saliviano 1492, die XII Decembris.

The oldeſt Papal privilege hitherto known, is of the year 1505, to *Hervei Britonis in* IV *Petri Lombardi ſententiarum volumina ſcripta ſubtiliſſima.*

The following liſt of a few of the oldeſt privileges is collected from Putter * and Hoffmann †.

1494. A Venetian, to *Vincentii Bellovacenſis Speculum hiſtoriale.*

1495. A Milaneſe, by duke Louis Sforza, to Michael Ferner and Euſtachius Silber for *I. A. Campani Opera.*

1497. A Venetian, for an edition of Terence.

* Der büchernachdruck nach ächten grundſätzen des rechts geprüft, *ut ſupra.*

† Von denen älteſten kayſerlichen und landesherrlichen bücher-druck- oder verlag-privilegien, 1777, 8vo.

1501.

1501. *Privilegium ſodalitatis Celticae a ſenatu Romani imperii impetratum*, to Conrade Celtes' edition of the works of Hroſwitha.

1506. A papal, of pope Julius II, to Evangeliſta Toſino the bookſeller, for *Ptolomaei Geographia.*

1507. A French, of Louis XII to Antoine Verard.

1507. A Venetian, for *Epytoma ſapientie.*

1510. The firſt Imperial, to *Lectura aurea ſemper Domini abbatis antiqui* *.

1512. An Imperial, to Jacob Spiegel's Expoſition of *Aurelii Prudentii Clementis Hymni.*

1512. An Imperial, to Roſslin's *Swangere frauwen roſegarten.*

1514. An Imperial, to *Kayſersbergers Predigten.*

1515. An Imperial, to *Riccardi Bartholini Lib. de bello Norico.*

1515. An Imperial, to *Germania Enee Sylvii.*

1517. A book on medicine : *impreſſum in emporio Antverpiano—cum gratia et privilegio.*

1519. An Imperial, to *Pontani de immanitate liber.*

1527. A privilege from the duke of Saxony to the edition of the New Teſtament by Emſer.

* Among the oldeſt Imperial privileges may be reckoned that to the edition of Ptolemy of 1513. *Argentinae cum gratia et privilegio imperiali per decem annos.*

In the year 1495, Aldus publiſhed the works of Ariſtotle, at the end of the firſt part of which we find the following notice: Conceſſum eſt eidem Aldo inventori ab illuſtriſſimo ſenatu Veneto, ne quis queat imprimere neque hunc librum, neque caeteros quos is ipſe impreſſerit; neque ejus uti invento. The laſt words allude to the Greek types which were employed in printing the Aldine editions of the Greek claſſics *.

In 1498 were printed at Venice, in quarto, *Ephemerides, ſive Almanach perpetuus.* At the end ſtands: Expliciunt Ephemerides ſolis, lunae planetarumque perpetui, impenſis, opera et arte impreſſionis mirifica Petri Liechtenſtein colonienſis explete, anno ſiderum conditoris 1498. Venetiis. Cum gratia et privilegio.

Mr. Hoffmann ſpeaks in a very doubtful manner reſpecting a privilege of the year 1517, granted to John Scheffer for his edition of Livy, and ſays that he had ſought for it in vain. For this reaſon, and becauſe that edition, which I have now before me from the library of our univerſity, is exceedingly ſcarce, and becauſe the privilege itſelf contains ſome things worthy of notice, I ſhall here give it at full length. The edition however is of 1518.

* See Hambergers Zuverläſſigen nachrichten von den ſchriftſtellern, i. p. 123, 267.

MAX-

MAXIMILIANUS divina favente clementia Romanorum Imperator ſemper Auguſtus, ac Germaniae, Hungariae, Dalmatiae, Croatiae, &c. Rex, Archidux Auſtriae, Dux Burgundiae, Brabantiae, &c. Comes Palatinus, &c. Honeſto noſtro, et ſacri imperii fideli nobis dilecto Ioanni Scheffer Chalcographo Moguntino gratiam noſtram Caeſaream et omne bonum. Cum, ſicut docti et moniti ſumus fide dignorum teſtimonio, ingenioſum chalcographiae, authore auo tuo, inuentum felicibus incrementis in univerſum orbem permanaverit, et fere omnes chalcographi, non modo per imperii noſtri ditionem, ſed alia etiam regna, gratia ſeu privilegio de non imprimendis libris ex officina eorum emanatis ſecundum vim obtenti cuiuſlibet privilegii gaudeant, ne eorum irritus labor fiat, et ſibi iacturam officio ſuo pariant, ſicut tibi in publicatione Liviana contigiſſe accepimus. Proinde volentes tibi, tum ob avum tuum, omni vel ob hoc divinum inventum favore et commendatione dignum, tum pro damni tui recuperatione, quod accepiſti ex praecipiti ſecundaria operum a te publicatorum editione, opportuno remedio ſuccurrere, et in poſterum proſpicere, omnibus et ſingulis, cuiuſcunque conditionis exiſtant, Chalcographis et librorum impreſſoribus, ubilibet locorum in ſacro Romano imperio, et etiam in terris noſtris haereditariis, conſtitutis ſub poena infra ſcripta ſerio inhibemus, ne Titum Livium per decennium, quem ſub incude in praeſentiarum habes, et Latinum et Germanicum,

cum, ac etiam auctiorem quam hactenus nunquam publicatus, edere proxime intendis, ac alia pleraque opera quacunque in lingua, quae tu primum apud Germanos, licet apud exteros impreſſa fuerint, publicabis, per ſexennium a dato editionis cuiuſlibet talium librorum et operum imprimere, ſeu alibi imprimi facere, aut poſt diem eorundem editionis impreſſos adducere, quovismodo, aut quaeſito colore ſtudeant vel praeſumant, aut ab aliis iſta fiant authores ſint, ſub poena amiſſionis librorum ſic editorum, aut vaenum expoſitorum, quos etiam praefatus Ioannes, aut cui ab eo agendum hoc commiſſum fuerit, de facto ubicunque eos compererit, accipere, et in commodum ſuum convertere poteris et poterit, impedimento, contradictione, et impugnatione ceſſante quorumcunque, cuiuſcunque dignitatis, praeeminentiae, ſtatus et officii fuerint. Et amplius ſub poena decem marcharum auri puri, quas toties quoties contrafactum fuerit, irremiſſibiliter exigendas a contrafacientibus, et pro medietate fiſco noſtro Caeſareo, pro reliqua vero iniuriam paſſi uſibus decernimus eſſe applicandas. Harum teſtimonio literarum ſigilli noſtri munimine roboratarum. Datum in oppido noſtro Vuels die nona menſis Decembris. An. M.D.XVIII. Regnorum noſtrorum, Romani XXXIII. Hungariae vero XXIX.

Ad mandatum Caeſareae
majeſtatis proprium.

Io. SPIEGEL.

Anderſon

Anderſon remarks on the year 1590, that the firſt excluſive patent, for printing a book in England, which occurs in Rymer's Fœdera *, was granted in the above year by queen Elizabeth, to Richard Weight of Oxford, for a Tranſlation of Tacitus. I am much aſtoniſhed that Anderſon, who was ſo often obliged to uſe Rymer's Fœdera, and who ſeems indeed to have conſulted it with attention, ſhould have overlooked the oldeſt patents which are to be found in that collection. In that laborious work, ſo important to thoſe who wiſh to be acquainted with the hiſtory of Britiſh literature, Ames' Typographical Antiquities, there are privileges of ſtill greater antiquity. The oldeſt which I obſerved in this work, though I may perhaps have overlooked ſome, are the following:

1510. The hiſtory of king Boccus - - - - printed at London by Thomas Godfry. Cum privilegio regali.

1518. Oratio Richardi Pacei - - - Impreſſa per Richardum Pynſon, regium impreſſorem, cum privilegio a rege indulto, ne quis hanc orationem intra biennium in regno Angliæ imprimat, aut alibi impreſſam et importatam in eodem regno Angliæ vendat.

* Vol. xvi. p. 96.

Other

Other works printed *cum gratia et privilegio* occur 1520, 1521, 1525, 1528, 1530, &c.

In the year 1483, when the well-known act was made againſt foreign merchants, foreigners however were permitted to import books and manuſcripts, and alſo to print them in the kingdom; but this liberty was afterwards revoked by Henry VIII, in the year 1535, by an order which may be found in Ames *. In 1538, Henry iſſued an order reſpecting the printing of bibles; and in 1542, he gave a bookſeller an excluſive privilege during four years for that purpoſe.

With a view of finding the oldeſt Spaniſh privilege I conſulted a variety of works, and among others *Specimen bibliothecae Hiſpano-Majanſianae* †, but I met with none older than that to the following book: *Aelii Antonii Nebriſſen Introductiones in Latinam Grammaticen.* Logronii Cantabrorum Vaſconum urbe nobiliſſima; anno ſalutis milleſimo quingenteſimo decimo. fol. That privileges to books were uſual in Poland, has been ſhewn by Mr. Am Ende, in Meuſel's Collections before mentioned; and Origny, in his *Dictionnaire des Origines*, ſays, that the firſt privilege to a book in France was granted by Louis XII, in 1507; but Origny

* Page 494.

† Specimen bibliothecae Hiſpano-Majanſianae; ex muſeo Davidis Clementis. Hanoverae 1753, 4to.

is

is an author in whoſe teſtimony one cannot place much confidence.

CATALOGUES OF BOOKS.

THE firſt printers printed books at their own expence, and ſold them themſelves. It was neceſſary therefore, that they ſhould have large capitals. Paper and all other materials, as well as labour, were in the infancy of the art exceedingly dear for thoſe periods; and, on the other hand, the purchaſers of books were few, partly becauſe the price of them was too high, and partly becauſe, knowledge being leſs widely diffuſed, they were not ſo generally read as at preſent. For theſe reaſons many of the principal printers, notwithſtanding their learning and ingenuity, became poor *. In this manner my countrymen Conrade Sweinheim and Arnold Pannarz, who were the firſt, and for a long time the only, printers at Rome, a city which on many accounts, particularly in the ſixteenth century, might be called the firſt in Chriſtendom, were obliged, after the number of the

* Several of them were editors, printers, and proprietors of the books which they ſold.

volumes

volumes in their warehouſes amounted to 12,475, to ſolicit ſupport from the Pope *. In the courſe of time this profeſſion was divided, and there aroſe bookſellers. It appears that the printers themſelves firſt gave up the bookſelling part of the buſineſs, and retained only that of printing; at leaſt this is ſaid to have been the caſe with that well-known bookſeller John Rainmann, who was born at Oehringen, and reſided at Augſburg †. He was at firſt a printer and letter-founder; and from him Aldus purchaſed his types. Books of his printing may be found from the year 1508 to 1524; and in many he is ſtyled the celebrated German bookſeller. About the ſame period lived the bookſellers Joſ. Burglin and George Diemar. Sometimes there were rich people of all conditions, particularly eminent merchants, who cauſed books which they ſold, to be printed at their own expence. In this manner that learned man Henry Etienne was printer at Paris to Ulric Fugger at Augſburg, from whom he received a ſalary for printing the many manuſcripts which he purchaſed. In ſome editions, from the year 1558 to 1567, he ſubſcribes himſelf *Henricus Stephanus, illuſtris viri Hulderici*

* Their lamentable petition of the year 1472 has been inſerted by Fabricius in his *Bibliotheca latina*. Hamburgi 1712, 8vo. iii. p. 898. See alſo *Putter von Büchernachdruck*, p. 29.

† Mr. Von Stetten, Kunſt-geſchichte der reichs-ſtadt Augſburg, p. 43.

Fuggeri

Fuggeri typographus *. In the like manner alſo, in the beginning of the laſt century, a ſociety of learned and rich citizens of Augſburg, at the head of whom was Marx Welſer, the city-ſteward, printed a great number of books, which had commonly at the end theſe words, *Ad inſigne pinus* †. Printing therefore thus gave riſe to a new and important branch of trade, that of bookſelling, which was eſtabliſhed in Germany, chiefly at Franckfort on the Mayn, where, at the time of the fairs particularly, there were ſeveral large bookſellers-ſhops in that ſtreet which ſtill retains the name of *book ſtreet*.

George Willer, whom ſome improperly call Viller, and others Walter, a bookſeller at Augſburg, who kept a very large ſhop, and frequented the Franckfort fairs, firſt fell upon the plan of cauſing to be printed every fair a catalogue of all the new books, in which the ſize, and printers' names were marked. Le Mire, better known under the name of Miræus ‡, ſays, that catalogues were firſt

* Von Stetten, p. 68.

† Ibid. p. 40.

‡ Le Mire, a Catholic clergyman, who was born in 1598, and died in 1640, wrote a work *De ſcriptoribus eccleſiaſticis ſæculi* xvi. which is printed in *Fabricii Bibliotheca eccleſiaſtica*, Hamburgi 1718, fol. The paſſage to which I allude may be found p. 232; but perhaps 1564 has been given in Fabricius inſtead of 1554 by an error of the preſs.

printed

printed in the year 1554; but Labbe *, Reimann † and Heumann ‡, who took their information from Le Mire, make the year erroneously to be 1564. Willer's catalogues were printed till the year 1592 by Nicol. Baſſæus, printer at Franckfort. Other bookſellers however muſt have ſoon publiſhed catalogues of the like kind, though that of Willer continued a long time to be the principal.

Among the many curious and rare articles in the library of profeſſor Baldinger, there is a collection of old catalogues, the earlieſt of which are the following: *Catalogus novus nundinarum autumnalium* Francofurti ad Moenum anno 1586 celebratarum. Plerique apud Joan. Georg. Portenbachium et Th. Lutz bibliopolam Auguſtanum venales habentur: *A catalogue of all the new books*—printed at Franckfort by Peter Schmid ||. This catalogue was publiſhed by bookſellers of Augſburg; but not by Willer, of whom we have: *Catalogus novus nundinarum autumnalium* Francofurti ad Moenum anno 1587——Plerique in aedibus Georgii Willeri, bibliopolae Auguſtani, venales ha-

* Labbe, Bibliotheca bibliothecarum. Lipſiæ 1682, 12mo. p. 112.

† Einleitung in die *Hiſtoriam literariam*, i. p. 203.

‡ Conſpectus reip. litter. c. vi. § 2. p. 316.

|| Verzeichnuſs aller neuwer bucher—Gedruckt in Frankfort durch Peter Schmid.

bentur.

bentur. *A catalogue of almoſt all the books which have been publiſhed between laſt Eaſter and the preſent September fair.* Franckfort on the Mayn printed by Nicolas Baſſæus *.

In all theſe catalogues, which are in quarto, and not paged, the following order is obſerved. The Latin books occupy the firſt place, beginning with the Proteſtant theological works, perhaps becauſe Willer was a Lutheran; then come the Catholic; and after theſe books of juriſprudence, medicine, philoſophy, poetry and muſic. The ſecond place is aſſigned to German books, which are arranged in the ſame manner.

The laſt Eaſter catalogue of Willer which I find in profeſſor Baldinger's library, is of the year 1597. On the title is: *Plerique libri in ædibus Eliæ et Georgii Willeri fratrum bibliopolarum Auguſtanorum habentur.* It is printed alſo by Baſſæus at Franckfort. George and Elias Willer were perhaps ſons of the former.

In the year 1604, the general Eaſter catalogue was printed with a permiſſion from government, as appears by the following title: *Catalogus univerſalis pro nundinis Francof. de anno* 1604—A catalogue of all the new books, or books improved and repub-

* Verzeichnuſs faſt aller neuwer bucher welche ſeyther der nechſtverſchienen faſtenmeſs, biſs auff dieſe gegenwertige herbſtmeſs, in offentlichem truck ſeyn auſſgangen. Gedruckt zu Frankfurt a M. durch Nicolaum Baſſæum.

liſhed, which will be expoſed for ſale in Book-ſtreet, Franckfort, during the Eaſter fair 1604. Francofurti permiſſu ſuperiorum excudebat Joh. Saur. To be had at the ſhop of Peter Kopff. The order of the books is the ſame as before.

After this the Leipſic bookſellers began not only to reprint the Franckfort catalogues, but to enlarge them with many books which had not been brought to the fairs in that city. I have, from profeſſor Baldinger's library, *Catalogus univerſalis pro nundinis Francofurtenſibus vernalibus de anno* 1600 - - - or A catalogue of all the books on ſale in Book ſtreet, Franckfort, and alſo of the books publiſhed at Leipſic, which have not been brought to Franckfort, with the permiſſion of his highneſs the elector of Saxony to thoſe new works which have appeared at Leipſic. Printed at Leipſic, by Abraham Lamberg; and to be had at his ſhop. On the September catalogue, of the ſame year, it is ſaid that it is printed from the Franckfort copy, with additions. I find an Imperial privilege, for the firſt time, on the Franckfort September catalogue of 1616: *cum gratia et privilegio ſpeciali ſ. caeſ. maj. Proſtat apud J. Krugerum Auguſtanum.* Some Imperial permiſſions, however, may be of an earlier date; for I have not ſeen a complete ſeries of theſe catalogues.

Reimmann

Reimmann * ſays that, after Willer's death, the catalogue was publiſhed by the Leipſic bookſeller Henning Groſſe, and by his ſon and grandſon. The council of Franckfort cauſed ſeveral regulations to be iſſued reſpecting catalogues; an account of which may be ſeen in *D. Orth's Treatiſe on the Imperial Fairs at Franckfort* †. After the buſineſs of book-ſelling was drawn from Franckfort to Leipſic, occaſioned principally by the reſtrictions to which it was ſubjected at the former by the cenſors, no more catalogues were printed there; and the ſhops in Book-ſtreet were gradually converted into taverns ‡.

In peruſing theſe old catalogues one cannot help being aſtoniſhed at the ſudden and great increaſe of books; and when one reflects that a great, perhaps the greater, part of them no longer exiſt, this periſhableneſs of human labours will excite the ſame ſenſations as thoſe which ariſe in the mind when one reads in a church-yard the names and titles of perſons long ſince mouldered into duſt. In the ſixteenth century there were few libraries; and theſe, which did not contain many books, were in

* Part iii. chap. 3. p. 766.

† Abhandlung von den reichs-meſſen in Franckfurt. Frankf. 1765. 4to. p. 500.

‡ Joh. Adolph. Stock, Frankfurter Chronik, p. 77.

monaſteries, and conſiſted principally of theological, philoſophical, and hiſtorical works, with a few, however, on juriſprudence and medicine; while thoſe which treated of agriculture, manufactures, and trade, were thought unworthy of the notice of the learned, and of being preſerved in large collections. The number of theſe works was, nevertheleſs, far from being inconſiderable; and, at any rate, many of them would have been of great uſe, as they would have ſerved to illuſtrate the inſtructive hiſtory of the arts. Catalogues which might have given occaſion to inquiries after books, that may be ſtill ſomewhere preſerved, have ſuffered the fate of tomb-ſtones, which, being waſted and crumbled to pieces by the deſtroying hand of time, become no longer legible. A complete ſeries of them, perhaps, is no where to be found; at leaſt, I do not remember to have ever ſeen one in any library.

This loſs might, in ſome meaſure, be ſupplied by two works, were they not now exceedingly ſcarce. I mean thoſe of Cleſs and Draudius; who, by the deſire of ſome bookſellers, collected together, as Georg at a later period, all the catalogues publiſhed at the different fairs in different years. The work of Cleſs has the following title: *Unius ſæculi ejuſque virorum litteratorum monumentis tum florentiſſimi, tum fertiliſſimi, ab anno* 1500

ad 1602 *nundinarum autumnalium inclusive, elenchus consummatissimus—desumtus partim ex singularum nundinarum catalogis, partim ex bibliothecis.* Auctore Joanne Cleffio, Wineccensi, Hannoio, philosopho ac medico *. By the editor's preface it appears that the first edition was published in 1592. The order is almost the same as that observed by Willer in his catalogues.

The work of Draudius, which was printed, in several quarto volumes, for the first time, in 1611, and afterwards in 1625, is far larger, more complete, and more methodical †. I have never seen a perfect copy of either edition; but, perhaps, the following information may afford some satisfaction to those who are fond of bibliography. One part, which I consider as the first, has the title of *Bibliotheca classica, sive Catalogus officinalis, in quo singuli singularum facultatum ac professionum libri, qui in quavis fere lingua extant—recensentur; usque ad annum*

* Francofurti, ex offic. Joannis Saurii, impensis Petri Kopffii 1602. 4to. The first part contains 563 pages, and the second 292.

† An account of both these works may be found in *Reimmanni Bibliotheca historiæ litterariæ, sive Catalogus bibliothecæ Reimmannianæ.* Hildesiæ 1738. 8vo. ii. p. 97—192. Reimmann says, that Draudius' Bibliotheca was printed three times at Franckfort, viz. in 1611, 1621, and 1644, which, however, is not perfectly correct.

1624 *inclusive.* Auctore M. Georgio Draudio *. It contains Latin works on theology, jurisprudence, medicine, history, geography, and politics. The copy in the library of our university ends at page 1304; which has, however, a catch-word that seems to indicate a deficiency. The second part is entitled, *Bibliotheca classica, sive Catalogus officinalis, in quo philosophici artiumque adeo humaniorum, poetici etiam et musici libri usque ad annum* 1624 *continentur.*

This part, containing Latin books also, begins at page 1298, and ends with page 1654, which is followed by an index of all the authors mentioned. A smaller volume, of 302 pages, without an index, has for title, *Bibliotheca exotica, sive Catalogus officinalis librorum peregrinis linguis usualibus scriptorum*; and a third part, forming 759 pages besides an index of the authors, is called, *Bibliotheca librorum Germanicorum classica*; that is, A catalogue of all the books printed in the German language till the year 1625. By the indices, and the proper arrangement of the matter, the use of this work is much facilitated. I must, however, observe that the oldest catalogues had the same faults as those of the present time †, and that these have been copied

* Francofurti ad M. impensis Balthasaris Ostern. 1625.

† I shall refer those who may be desirous of seeing a humorous com-

pied by Draudius. Many books are mentioned which were never printed, and many titles, names, and dates, are given incorrectly; but Draudius, nevertheleſs, is well worth the attention of any one who may be inclined to employ his time and ingenuity on the hiſtory of literature; and his work certainly was of uſe to Haller when he compoſed his Bibliotheca.

AURUM FULMINANS.

IF gold be diſſolved in aqua-regia, and precipitated with volatile lixivious ſalt, or with fixed lixivious ſalt, when the aqua-regia has been prepared with ſal ammoniac, a yellow powder will be obtained, which, when heated, or only bruiſed, explodes ſuddenly with a prodigious report. The force of this aurum fulminans is terrible, and, in the hands of incautious perſons, has often occaſioned much miſchief. But, however powerful, it cannot, as ſome have imagined, be employed inſtead of gunpowder, even were not this impoſſible on account of the high value of the metal from which it is

compariſon of the catalogues of 1619 with thoſe of 1780, and of the ſtate of literature at that period, with what it is at preſent, to Frommichen's Eſſay in the *Teutſche Muſeum* for September 1780, p. 176,

made; for explosion does not take place when the powder is confined. Phænomena of this kind are always of importance, and afford subject of speculation to the philosopher, though no immediate use can be made of them. Experiments, however, have rendered it probable that this powder may possess some medicinal virtues, and we are assured that it can be employed in enamel painting*.

In attempting to trace out the invention of aurum fulminans one is, like a person bewildered in a morass, in danger every moment of being lost. I allude here to the immense wilderness of the ancient alchemists, or makers of gold; to wade through which my patience, though pretty much accustomed to such labour, is not sufficiently adequate. Those who know how to appretiate their time will not sacrifice it in endeavouring to discover the meaning of books which the authors themselves did not, in part, understand, or to comprehend passages in which the writer tells us nothing, or, at any rate, nothing of importance. I have, however, made my way through this labyrinth from Spielmann to the works which are ascribed to one Basilius Valentin †.

* An account of the principal writers who have treated of aurum fulminans may be found in *Weigel's Chemie*, i. p. 225. See also *Lewis, Zusammenhang der künste*. Zurich 1764, 8vo. i. p. 172.

† Spielmann, Institut. chem. p. 288. Hanc calcem Bas. Valent. inter primos clare describit.

The

The period when this powder was invented is as uncertain as the accounts given of its compoſition. It is, however, probable that the diſcoverer was a German Benedictine monk, who lived about the year 1413 *; and there is reaſon to think that he may have made many uſeful obſervations, of which we are yet as ignorant as of the meaning of the Egyptian hieroglyphics; for both are almoſt equally unintelligible, though ſome, who poſſeſs more imagination and credulity than judgment, think they underſtand and can explain them. The Egyptian hieroglyphics are indeed totally incomprehenſible, but thoſe of Valentin only in part; for when new obſervations have been made reſpecting gold, they have been found afterwards in the works of Valentin, in a paſſage which no one before could underſtand. In this caſe theſe writings are of no more utility than the anſwers of the ancient oracles, which were comprehended when a knowledge of them was no longer neceſſary, and which miſled thoſe who ſuppoſed that they comprehended them earlier. But the account of aurum fulminans in Valentin is ſo uncommonly intelligible, that it almoſt ſeems he either wrote in an explicit manner without perceiving it, or that the words eſcaped from him contrary to his inten-

* See the preface of Bened. Nic Petræus to the Works of Valentin, printed at Hamburg 1717, in octavo.

tion,

tion. As the work in which it may be found, is ſcarce, I ſhall tranſcribe the preſcription *.

"Take a pound of aqua-regia made with ſal ammoniac; that is, take a pound of good ſtrong aquafortis, and diſſolve in it four ounces of ſal ammoniac, and you will thus obtain a ſtrong aqua-regia, which muſt be repeatedly diſtilled and rectified, until no more feces remain at the bottom, and until it become quite clear and tranſparent. Take fine thin gold-leaf, in the preparation of which antimony has been uſed; put it into an alembic; pour aqua-regia over it; and let as much of the gold as poſſible be diſſolved, After the gold is all diſſolved, add to it ſome *oleum tartari*, or *ſal tartari* diſſolved in a little ſpring-water, and it will begin to effervеſce. When the effervеſcence has ceaſed, pour ſome more oil into it; and do this ſo often till the diſſolved gold fall to the bottom, and until no more precipitate is formed, and the aqua-regia remains pure and clear. You muſt then pour the aqua-regia from the gold calx, and waſh it well with water eight or ten times. When the gold calx is ſettled, pour off the water, and dry the calx in the open air when the ſun ſhines, but

* Fr. Baſilii Valentini, Benedictiner ordens, Letztes teſtament; von Georg Philips Nenter, Med. Doct. Straſburg 1712. 8vo. p. 223.

not

not over the fire; for as ſoon as this powder becomes a little heated or warm, it explodes, and does much miſchief, as it is ſo powerful and violent that no man can withſtand it. When the powder has been thus prepared, take ſtrong diſtilled vinegar and pour over it; keep it continually over the fire for twenty-four hours, without ſtirring it, ſo that nothing may fall to the bottom, and it will be again deprived of its power of exploding; but take great care that no accident happen by careleſſneſs. Pour off the vinegar, and, having waſhed the powder, expoſe it to dry."

The latter part of the receipt ſhews that Valentin had made experiments in order to diſcover how aurum fulminans might be deprived of its power of exploding, and he found that this could be done by vinegar. It appears from his writings, that he had diſcovered alſo that the ſame thing could be effected by ſulphur *.

After the time of Valentin, Crollius, who lived in

* See Bergmann's Treatiſe on Pulvis fulminans, tranſlated from the Latin, in *Baldingers Magazin für Aerzte* 1777, part vii. p. 600. This treatiſe may be found alſo, but reviſed and enenlarged, in *T. Bergmanni Opuſcula phyſica et chemica*, 1780, 8vo. vol. ii. p. 133. On the effect of vinegar Bergmann ſays, p. 151: Ad ſiccum diſtillando acetum adfuſum, fulminandi vis domata reperitur, quod tamen intelligendum eſt de reſiduo vel non edulcorato, vel etiam ope caloris reducto.

the

the laſt half of the ſixteenth century, ſeems to have been beſt acquainted with this powder, and to have principally made it known * : at any rate his works are referred to by moſt of the modern writers. He calls it *aurum volatile*, and ſpeaks of its being uſeful in medicine. The name *aurum fulminans* was, as far as I know, firſt uſed by Beguin †. The method of preparing it is deſcribed by Kircher, who conſiders it as a thing uncommon, and who calls it *pulvis pyrius aureus* ‡.

C A R P.

So obſcure is the ichthyology of the ancients, or ſo little care has been taken to explain it, that the queſtion whether our carp were known to Ariſtotle, Pliny,

* Oſualdi Crollii Baſilica chymica. Francofurti (1609) 4to. p. 211.

† J. Beguini Tyrocinium chymicum was printed for the firſt time at Paris, in 1608, 12mo. In the French tranſlation, *Les élemens de chymie de maiſtre Jean Beguin; reveus, expliquez et augmentez par Jean Lucas de Roy*; troiſième edition, Paris 1626, 8vo; the receipt for making *or fulminant* may be found p. 314.

‡ Kircheri Magnes. Coloniæ 1643, 4to. p. 548. The author ſays, that he found the receipt for preparing it in *Liber inſigni*

Pliny, and their cotemporaries, cannot with any great degree of probability be determined. Beſides, that ſubject is attended with much greater difficulties than the natural hiſtory of quadrupedes. Among four-footed animals there is a greater variety in their bodily conformation, which at any rate ſtrikes the eye more, and can be more eaſily deſcribed than that of fiſhes, which in general are ſo like in ſhape, that an experienced ſyſtematic naturaliſt finds it ſometimes difficult to determine the characteriſing marks of the genera and ſpecies. It is not ſurpriſing therefore that the ſimple deſcriptions of the ancients, or rather the ſhort accounts which they give us of fiſh, do not afford information ſufficient to enable us to diſtinguiſh with accuracy the different kinds. Quadrupedes may terrify us by their ferocity, or endeavour to avoid us by ſhyneſs and craft; but it is ſtill poſſible to obſerve their ſexes, their age, and their habits, and to remark many things that are common to one or only a few ſpecies. Fiſhes, on the other hand, live in an element in which we cannot approach them, and which for the moſt part con-

ſignis de incendio Veſuvii. That I might know whether this work contained any thing reſpecting the hiſtory of aurum fulminans, I inquired after it. Kircher undoubtedly meant *Incendio del monte Veſuvio, di Pietro Caſtelli*; in Roma 1632, 4to: but the directions given there, p. 46, for making *oro fulminante*, are taken from Crollius. Nothing farther is to be found in Kircher's *Mundus Subterraneus*. Amſtel. 1678, fol. i. p. 229.

ceals

ceals them from our obſervation. The chace, ſince the earlieſt periods, and in modern times more than formerly, has been the employment of idle perſons, who beſtow upon it greater attention the fewer thoſe objects are which can attract their curioſity or employ their minds: but fiſhing has almoſt always been the laborious occupation of poor people, who have no time to make obſervations, as they are obliged to follow it in order to find a ſubſiſtence; and mankind in general ſeldom ſee fiſh except on their tables or in collections of natural hiſtory. On this account thoſe properties of fiſh by which their ſpecies could be determined, are leſs known. The deſcriptions of four-footed animals which have been handed down to us from the time of the Greek and Roman writers give us, at any rate, ſome information; but from thoſe of fiſhes, which are more uncommon, we can ſcarcely derive any; unleſs one were as acute or eaſy of belief as many collectors of petrifactions, who imagine that they can diſtinguiſh each ſpecies of fiſh in the impreſſions which they ſee in ſtones. More however might be done towards elucidating the ichthyology of the ancients than has hitherto been attempted. It would be neceſſary only to make a beginning by collecting the ſpecies and names which can be with certainty determined, together with the authorities, and ſeparating them from the reſt; and one ſhould form an abſtract of what

what is ſaid in the ancients reſpecting the unknown ſpecies, or whatever may in any meaſure ſerve to make us acquainted with them; but one ought never to give mere conjectures for proofs, nor adopt the opinions of commentators, or the explanations of dictionaries, without ſufficient grounds. If we can believe theſe, without farther examination, the names *cyprini* and *lepidoti* muſt be conſidered as thoſe of carp; and the propoſed queſtion would be ſoon anſwered: but that opinion has ſcarcely probability in its favour when one ſearches after proofs.

I ſhall not here lay before the reader every thing completely that the ancients have ſaid reſpecting the *cyprini*, and which is in part ſo corrupted by tranſcribers, that no certain meaning can be drawn from it. Were I to treat of the ichthyology of the ancients, it might be neceſſary; but as that is not the caſe, I ſhall only quote ſuch parts of it as have been employed by Rondelet and others to prove that they were our carp. Their principal grounds ſeem to be, that amongſt all the fiſh of the ancients no others occur which can with any probability be conſidered as carp. If the *cyprini* therefore were not carp, theſe muſt not have been named by the ancients; and that undoubtedly will not readily be admitted. It is well known what a high value the ancients, particularly the Orientals, ſet upon fiſh, of which they had a great variety; and it appears

that

that they preferred them to all diſhes prepared from four-footed animals or fowls*. Fiſh ſeem to have been the choiceſt delicacies of voluptuaries, and in that reſpect they are oftener mentioned by hiſtorians than fowls. Phyſicians alſo, to whom the moſt ſumptuous tables have in all ages been of the greateſt benefit, ſpeak of fiſh oftener in their writings than of diſhes made of the fleſh of other animals. In the antient cookery, the number of diſhes prepared from fiſh is indeed great in compariſon of thoſe dreſſed from fowls. *Turdi* and *attagines* are much praiſed; but had pheaſants, ſnipes, partridges, and others, been as much eſteemed then as they are at preſent, theſe would not have been forgotten, or would have occurred oftener. Fiſh, at preſent, form the principal food in Greece, as well as at Conſtantinople, and a great abundance and variety of them may be found there in the markets; but fowl which have been caught or ſhot are ſeldom expoſed for ſale. When the Egyptian and Greek monks wiſhed to diſtinguiſh themſelves by abſtinence and temperance, they denied themſelves all kinds of fiſh, as the richeſt delicacies, in the ſame manner as pretended devotees among the Europeans deny themſelves fleſh. But though all this may be true,

* Οψον properly ſignified fiſh, but in the courſe of time it was uſed for every dainty, and οψοφαγια and φιλοψια had the ſame ſignification as the French words *gourmandiſe*, *friandiſe*. See *Plutarch. Sympoſ.* iv. 3. p. 667. and *Voſſius De idololat.* iv. 23. p. 1371.

it

it does not prove that our carp muſt occur in the writings of the ancients. The Roman voluptuaries, indeed, left very little untried that was likely to gratify their appetite; but it was impoſſible for them to make a trial of every thing. There may have been particular reaſons alſo which prevented them from meeting with carp; and who will venture to affirm, that all the knowledge of the ancients muſt be contained in thoſe few of their writings which have been preſerved to us by accidents?

If one, freed from theſe prejudices, ſhould now aſk why the *cyprinus* muſt be our carp, the anſwer will be, becauſe what we read of the tongue and ſcales of the *cyprini* cannot be applied with ſo much propriety to any ſpecies of fiſh as to the *cyprinus carpio* of Linnæus. Ariſtotle informs us that the *cyprini* had properly no tongue, but that their ſoft fleſhy palate might very readily be taken for one *. Athenæus affirms that they had a tongue, but that it lay in the upper part of the mouth or palate; and in confirmation of this, he refers to Ariſtotle †. This aſſertion of Athenæus

* Hiſtor. Animal. lib. iv. cap. 8. p. 477. I follow the reading of the beſt edition, or that of Sylburgius: μησκοπουμενος, which is adopted by Voſſius and H. Schneider in *Artedi Synonymia piſcium*. Lipſiæ 1789, 4to. p. 8. Camus reads with Scaliger μιν inſtead of μη.

† Lib. vii. p. 309.

however is very dubious; for theſe words are not to be found in the works of Ariſtotle which have been preſerved, though the ſame meaning might be indeed forced, in caſe of neceſſity, from the paſſage firſt quoted. It is poſſible that Athenæus, as Caſaubon * has already conjectured, may here, as well as in other parts, allude to ſome book of Ariſtotle not now extant. Beſides, he calls the fiſh of which he ſpeaks, not *cyprinus*, but *cyprianus*; and a queſtion therefore ariſes, whether he may not have meant ſome other kind. This much at any rate appears certain from the paſſage of Ariſtotle, that the *cyprinus* had a thick fleſhy palate; and that indeed is the caſe with our carp, ſo that the head, on account of the delicacy and agreeable taſte of the palate, is reckoned the moſt reliſhing part. By that circumſtance however nothing is proved; as it is not peculiar to carp alone, but common to every ſpecies of the ſame genus, ſuch as the bream, tench, &c. Fiſh of this kind, ſays Mr. Bloch, have properly no tongue; that which appears to be one is merely a cartilaginous ſubſtance which projects through thoſe band-like parts that encloſe it on each ſide †. This proof would have more weight,

* Animadverſ. vii. 17. p. 540.

† Fiſche Teutſchlands, i. p. 26. *Blaſii Anatome animalium*, p. 263 and p. 472. fig. 4. Quod lingua vulgo dicitur, proprie non eſt lingua; nam in ſuperiori palato hæret, ita ut cibus ſub ea tranſeat, ſed eſt glanduloſa quædam ſubſtantia alba, mollis, humida, et quæ puncta aut alio modo læſa ſe miro modo commovet.

did

did we find it related, that in the time of Ariſtotle, the tongue was conſidered as an exquiſite morſel: but that is not mentioned; and H. Krunitz * is miſtaken, when he ſays that Heliogabalus, to ſatisfy his luxurious appetite, was induced to try a fricaſſee of the tongues of carp: it conſiſted only of the tongues of peacocks and nightingales †. Had the ancients really uſed carp on their tables, we muſt have aſcribed to them the diſcovery of theſe delicious fiſh.

The other proof which is brought from the ſcales conſiſts in what is ſaid by Dorion, in Athenæus ‡, that the *cyprianus* was called alſo by ſome *lepidotus*, or ſcaly. As all fiſh have ſcales, the ſcales of this ſpecies muſt have been extremely large, as they got that name by way of eminence ||; and it muſt be indeed allowed, that the above epithet would ſuit our carp exceedingly well, as their ſcales, as is known, are very large. But this circumſtance alone proves nothing, as the *mullus* and *mugil* have ſtill larger ſcales; and to the firſt genus belonged one of the fiſh moſt eſteemed by the ancients §.

Strabo

* Œkonomiſche Encyclopedie, xxxv. p. 138.

† Ælii Lampridii Vita Heliogab. c. 20. p. 484.

‡ Lib. vii. p. 309.

|| Orpheus, in his Poem on Stones, ix. 6. p. 317, aſcribes to the *lepidotus* bright ſilver-coloured ſcales.

§ This fiſh was a firſt-rate article of luxury among the Ro

Strabo mentions the *lepidotus* among the ſacred fiſh of the Nile; but whether it be the ſame as that of which Dorion ſpeaks, cannot be determined. It is however certain, that the Nile contains carp ſtill; for Norden ſaw them caught at the waterfall near Eſſuane, which is the ancient Syene *. Did we know that the modern Greeks at preſent call carp *cyprini*, this would prove more; for it is an undoubted fact, that the ancient names have for the moſt part been retained in Greece. We are aſſured by Maſſarius †, that the Greeks ſtill uſe the name *cyprinus*; but Gyllius ſays, that it is employed only by a few: and this is confirmed by Bellon, who mentions all the names of carp which he heard in Greece, and which are entirely different from the ancient ‡; but he adds, that carp in Ætolia are

mans, and was purchaſed at a dear rate. Juvenal ſays: Mullum ſex millibus emit, æquantem ſane paribus feſtertia libris. See *Plin.* lib. ix. c. 17. The Italians have a proverb: *La triglia non mangia chi la pigliа*, which implies, that he who catches a mullet is a fool if he eats it and does not ſell it. When this fiſh is dying, it changes its colours in a very ſingular manner till it is entirely lifeleſs. This ſpectacle was ſo gratifying to the Romans, that they uſed to ſhew the fiſh dying in a glaſs veſſel to their gueſts before dinner. Oculos antequam gulam pavit. *Seneca.* TRANS.

* Nordens Reiſe durch Ægypten. Breſl. und Leipz. 1779, 8vo. p. 376.

† Franc. Maſſarii Venеti in nonum Plinii de Nat. Hiſt. librum caſtigationes et annotationes. Baſiliæ 1537, 4to.

‡ A great ſervice would be rendered to the natural hiſtory of the

are ſtill called *cyprini*. Both the before-mentioned circumſtances reſpecting the *cyprini* agree extremely well with our carp; but as they will ſuit other kinds equally well, they afford no complete proof, but only a probability which amounts to this, that among the large-ſcaled fiſh, carp in particular have a fleſhy palate; and it is readily admitted that the ancients were acquainted with all kinds, and choſe names for them with more foundation than is done at preſent.

In oppoſition to this probability, it may be ſaid, that Oppian * and Pliny † reckon the *cyprini* among the ſea-fiſh, to which kind our carp do not belong. This reply, however, which ſome have indeed made, is not of great weight. In the firſt place, both theſe writers ſeem to have been in an error; for what Pliny ſays of the *cyprini* is evidently taken from Ariſtotle, and the latter does not tell us that theſe fiſh live in the ſea, but rather the contrary. The Roman author, as Dalechamp remarks, added the words *in mari*, if they were not added by ſome tranſcriber. Oppian, as a poet, does not always adhere ſtrictly to truth; and he

the ancients, if ſome able ſyſtematic naturaliſt would collect all the Greek names uſed at preſent. Tournefort and others made a beginning.

* Halieut. i. 101 and 592.

† Lib. ix. cap. 16. p. 509.

makes more of the freſh-water fiſh of Ariſtotle to be inhabitants of the ſea. In the ſecond place, I conſider the diſtinction made between ſea-fiſh, freſh-water fiſh, and thoſe kept in ponds, to be not always very certain or well founded. Who knows whether the greater part of the laſt may not have been originally ſea-fiſh? This is the more probable in regard to carp, as profeſſor Foſter ſays, that carp are ſometimes caught in the harbour at Dantzic *.

In order to anſwer the queſtion here propoſed, another point may be conſidered. As all nations at preſent give theſe fiſh the ſame name, it is probable that it was brought with them from that country where they were firſt found, and from which they were procured. Caſſiodorus, who lived in the ſixth century, is the oldeſt author as yet known in whom that name has been obſerved †. In a paſſage where he ſpeaks of the moſt delicate and coſtly fiſh, which at that time were ſent to the tables of princes, he ſays, Among theſe is the *carpa*, which is produced in the Danube. In the earlieſt Latin tranſlation of Ariſtotle, the word *cyprinus*, as

* Philoſophical Tranſact. vol. lxi. 1771, part i. p. 310.

† Privati eſt, habere quod locus continet; in principali convivio hoc profecto decet exquiri, quo viſum debeat admirari. Deſtinet carpam Danubius. *Variarum* lib. xii. 4to. p. 389. Edition of Geneva, 4to. 1650.

Camus

Camus ſays, is expreſſed by *carpra*. In the thirteenth century this fiſh was called by Vincentius de Beauvais * *carpera*, and by Cæſarius *carpo* †; and it is highly probable that both theſe names allude to our carp. By the above paſſage of Caſſiodorus, the opinion that theſe fiſh were the *cyprini* of the ancients obtains a new, but at the ſame time a very feeble, proof; for the *cyprinus* was found alſo in the Danube, as we learn from Ælian ‡, who, among the fiſh of the Iſter, mentions black *cyprini*; and theſe, according to the conjecture of profeſſor Schneider, were the black fiſh of the Danube which Pliny conſiders as unhealthful or poiſonous, and like which there were ſome in Armenia. Our carp indeed are not poiſonous, but Pliny alludes to a particular variety, and what he ſays was only report, to which however ſomething muſt have given riſe, as alſo to the idea of carp with a death's head, and the head of a pug-dog, as ſome have been

* Carpera piſcis eſt quaſi ſquamis aureis, in lacis vel fluviis, ſic dicta, quaſi quæ carpens pavit, &c. *Speculum naturale*, xvii. 40. p. 1274. According to the edition of the Benedictines, Duaci 1624. fol.

† Poſt hæc frater Simon vidit dæmonem loricatum et galeatum, habentem ſquamas, tanquam piſcis qui vocatur carpo. *Dialogi miraculorum*, diſtinct. ii. cap. 29. This book forms the ſecond part of the *Bibliotheca patrum Ciſtercienſium*. Bono-Fonte 1662, fol.

‡ De nat. animal. xiv. 23. Plin. xxxi. ſect. 19. p. 550. Antigonus Caryſt. cap. 181. p. 222.

repreſented by writers of the ſixteenth century. The *carpo* of Cæſarius appears to have been our carp, becauſe its ſcales had a very great reſemblance to thoſe of the latter; for we are told in the work already quoted, that the devil, once indulging in a frolic, appeared in a coat of mail, and had ſcales like the fiſh *carpo*. The *carpera* of Vincent de Beauvais is ſtill leſs doubtful, as the ſame craft in avoiding rakes and nets is aſcribed to that fiſh as is known to be employed by our carp. Sometimes they thruſt their heads into the mud, and ſuffer the net to paſs over them; and ſometimes they join the head and tail together, and ſeparating them ſuddenly, throw themſelves towards the ſurface of the water, and, ſpringing often four or five feet above the net, make their eſcape.

But whence did this name ariſe? The origin aſſigned by Vincentius, or the anonymous author of the loſt books *De natura rerum*, like another mentioned in ridicule by Geſner, is too ſilly to be repeated. More learned at any rate is the derivation of Menage who traces it from *cyprinus*, which was afterwards transformed into *cuprinus*, *cuprius*, *cuprus*, *cupra*, *curpa*, and laſtly into *carpa*. For my part, I am more inclined to derive it from a dialect which was ſpoken on the banks of the Danube, and to believe that it was brought with the fiſh from the ſouthern part of Europe; but I am too little acquainted with that dialect to be able to render my

conjecture

conjecture very probable; and the etymologists I consulted, such as Wachter, Ihre, Johnson, &c. afforded me no assistance. Fulda gave me some hopes, as he allows the word to be of German extraction *; but I must however confess, that his derivation is too far-fetched, and, like the chemistry of the adepts, to me not perfectly intelligible.

It may perhaps not be superfluous here to observe that one must not confound *carpa* and *carpo*, or our carp, with *carpio*. The latter belongs to the genus of the salmon and trout; and in the Linnæan system is called *salmo carpio*. It is found chiefly in the Lago di Garda, the ancient Lacus Benacus, on the confines of Tyrol †. The oldest account of this fish is to be found in works of the sixteenth century, such as the poems of Pierius Valerianus ‡, and in *Jovius de Piscibus* ||. According to Linnæus, it is found in the rivers of England, but that is false. This celebrated naturalist suffered himself to be misled by Artedi, who gives the char or chare, mentioned by Cambden in his description

* Germanische Würzelwörter, p. 71.

† Büschings Geographie, v. p. 585, where these fish are mentioned under the name of *carpioni*.

‡ The poem here alluded to is printed in Gesner, p. 219.

|| Jovius de Piscibus, cap. 35. p. 122. *Benacinus carpio*. He calls our carp, chap. 38. p. 131. *carpenæ*.

of

of Lancaſhire *, as the *ſalmo carpio*. Pennant however, by whom it is not mentioned among the Engliſh fiſh, ſays expreſsly, that the char is not the carpio of the Lago di Garda, but rather a variety of the *ſalmo alpinus* †.

That our carp were firſt found in the ſouthern parts of Europe, and conveyed thence to other countries, is undoubtedly certain. Even at preſent they do not thrive in the northern regions, and the farther north they are carried they become the ſmaller ‡. Some accounts of their tranſportation are ſtill to be found. If it be true that the Latin poem on the expedition of Attila is as old as the fifth or ſixth century, and if the fiſh which Walther gave to the boatman who ferried him over the Rhine, and which the latter carried to the kitchen of Gunther king of the Franks, were carp; this circumſtance is a proof that theſe fiſh had not been before known in that part of France which bordered on the Rhine ||. The examination of this conjecture

* Cambdeni Britannia in epitomen redacta a Ziricæo. Amſterd. 1639, 12mo. p. 347.

† Britiſh Zoology, vol. iii. p. 259.

‡ Pontoppidan, Natürliche hiſtorie von Norwegen, ii. p. 236.

|| Illic pro naulo piſces dedit antea captos,
Et mox tranſpoſitus graditur properanter anhelus.

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Porfitor

conjecture I ſhall however leave to others. D'Auſſy quotes a book never printed, of the thirteenth century, intitled *Proverbes*, and in which is given an account of the beſt articles produced at that time by the different parts of the kingdom, and aſſures us that a great many kinds of fiſh were mentioned in it, but no carp, though at preſent they are common all over France *.

It appears alſo that there were no carp in England in the eleventh century, at leaſt they do not occur in the Anglo-Saxon Dictionary of Aelfric, who, in 1051, died archbiſhop of York †. We are aſſured likewiſe, that they were firſt brought into the kingdom in the fifth year of the reign of Henry VIII, or in 1514, by Leonard Maſcal of Plum-

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Portitor exſurgens præfatam venit in urbem,
Regalique coco, reliquorum quippe magiſtro,
Detulerat piſces, quos vir dedit ille viator.
Hos cum pigmentis condiſſet et appoſuiſſet
Regi Gunthario, miratus fertur ab alto:
Iſtiuſcemodi nunquam mihi Francia piſces
Oſtendit, reor externis a finibus illos.

De prima expeditione Attilæ regis Hunnorum in Gallias, carmen edit. a F. C. J. Fiſcher. Lipſiæ 1780, 4to. x. 432.

Fiſcher, Sitten und gebräuche der Europäer im 5 und 6ten jahrhunderte. Frankf. 1784, 8vo. p. 121.

* Hiſtoire de la vie privée des Français, p. i. 2. p. 59.

† It may be found at the end of *Gul. Somneri Dictionarium Saxonico-Latino-Anglicum.* Oxonii 1659, fol. p. 55.

ſted in Suſſex *. What we read in the Linnæan Syſtem, that theſe fiſh were firſt brought to England about the year 1600, is certainly erroneous. Where that celebrated naturaliſt, under whom I had the pleaſure of ſtudying, acquired this information, I do not know.

Denmark is indebted for theſe fiſh to that celebrated ſtateſman Peter Oxe, who introduced them into

* This information I found in *Anderſon's Hiſtory of Commerce*, and in *Pennant's Britiſh Zoology*, vol. iii. p. 300. Both theſe authors refer to *Fuller's Britiſh Worthies*. Fuller compoſed a large work on the lives of celebrated Engliſhmen, who had rendered eſſential ſervice to their country, which, as far as I know, was never printed. We are told in the *Biographia Britannica*, vol. iii. p. 2059, that an abridgement of it was printed in quarto, under the fictitious title of *Abel redivivus*. Another abridgement, however, mentioned by Anderſon, under the title of *Engliſh Worthies in Church and State*, muſt have been printed in octavo in 1684. As I have ſeen none of theſe works of Fuller, I can give no farther account of this worthy Maſcal. I nevertheleſs flatter myſelf that I can rectify an error which has become very common. *Klein*, in *Hiſtoria piſcium*, v. p. 58, ſays: Leonard. Maſcal, libro de piſcat. primum ſe cyprinos, *carp*, in Angliam intuliſſe ſcribit. The ſame account has been repeated by Richter in his *Ichthyologie*, Leipzig 1754, 8vo. p. 792, by Krunitz in his *Encyclopedie*, xxxv. p. 11, and alſo by others. It appears to me highly probable, or rather certain, that a book by Nicolaus Marſchalk or Mareſchalcus, but who cannot be the Maſcal of Suſſex, is alluded to in the above paſſage. The former was a native of Thuringia, and died profeſſor of law and hiſtory at Roſtock in 1525. He wrote many hiſtorical works, which were much eſteemed, and of which a good account

into the kingdom as well as cray-fiſh, and other objects for the table. He died in the year 1575 *.

account may be found in various books, ſuch as the *Hamburgiſches Biblioth. hiſtorica*, cent. ii. p. 261; *Von Weſtphalen Monumenta edita*, tom. i. in the preface, and p. 459; and in *Fabricii Biblioth. medii ævi*, vi. p. 749. They are all very ſcarce, as the author printed only a few copies in his own printing-office, which was one of the firſt at Roſtock. See *Vogt, Catal. lib. rar.* p. 444, and *Freytag, Analecta litter. de lib. rar.* p. 572. The ſcarceſt however is the work mentioned by Klein, and which I never ſaw. The beſt account of it is in *Conr. Geſneri Hiſt. piſcium*, where the author enumerates all the writers on the ſubject of fiſhes. It is as follows: Nicolai Mareſchalci, Thurii, Hiſtoria aquatilium, impreſſa eſt Roſtochii in ædibus ipſius an. 1520, in fol. cum picturis, ſed fictis et abſurdis, iiſdem aut ſimillimis, quales in libris Bartholomæi Anglici et hujus farinæ ſcriptorum de rerum natura habentur. Sunt autem collectanea tantum ex auctoribus ordine alphabeti congeſta; proprium nihil, neque obſervatio ulla, neque nomen Germanicum ullum; quod hercle miror, cum de longinquis navigationibus ſuis per maria glorietur. Promittit et zoographiam et therion hiſtoriam, et ornithographiam, quæ ipſum præſtitiſſe non puto. As I knew that Schöttgen had given ſome account of the life of Marſchalk, I procured his work, which is intitled, *C. Schöttgenii Commentat. de vita N. Mareſchalci, quam ob raritatem recudi curavit* J. P. Schmidius, Roſtochii 1752, 4to. but I found in it nothing more concerning the above book than what is ſaid by Geſner. It is certain that the ſimilarity of the names Maſcal and Marſchalk has occaſioned them to be confounded, though the chriſtian name of the one was Leonard, and that of the other Nicholas.

* Algem. Welthiſtorie, xxxiii. p. 204. *Pontoppidan's Naturgeſchichte von Dannemark.* Copenhagen 1765, 4to. p. 190.

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We are told that theſe fiſh were brought from Italy to Pruſſia, where they are at preſent very abundant, by a nobleman whoſe name is not mentioned. This ſervice however may be aſcribed with more probability to the upper burggrave, Caſpar von Noſtiz, who died in 1588, and who in the middle of the ſixteenth century firſt ſent carp to Pruſſia from his eſtate in Sileſia, and cauſed them to be put into the large pond at Arenſberg not far from Creuzburg. As a memorial of this circumſtance the figure of a carp, cut in ſtone, was ſhewn formerly over a door at the caſtle of Arensberg. This colony muſt have been very numerous in the year 1535, for at that period carp were ſent from Konigſberg to Wilda, where the archduke Albert then reſided *. At preſent a great many carp are tranſported from Dantzic and Konigſberg to Ruſſia, Sweden, and Denmark. It appears to me probable, that theſe fiſh after that period became every where known and eſteemed, as eating fiſh in Lent and on Faſt-days was among Chriſtians conſidered to be a religious duty, and that on this account they endeavoured to have ponds ſtocked with them in every country, becauſe no ſpecies can be ſo eaſily bred in theſe reſervoirs.

I ſhall obſerve in the laſt place, that the *ſpiegel-*

* F. S. Bock, Naturgeſchichte von Preuſſen. Deſſau 1784, 8vo. iv. p. 642.

karpen,

karpen, mirror carp, diſtinguiſhed by yellow ſcales, which are much larger, though fewer in number, and which do not cover the whole body, are not mentioned but by modern writers. Mr. Bloch ſays that they were firſt deſcribed by Jonſton, under the name of royal-carp. The paſſage where he does ſo I cannot find ; but in plate xxix, there is a bad engraving, with the title *ſpiegel-karpen*, which however have ſcales all over their bodies, and cannot be the kind alluded to. On the other hand, the *ſpiegel-karpen* are mentioned by Geſner, who, as appears, never ſaw them *. In my opinion, Balbin, who wrote in the middle of the ſixteenth century, was the firſt perſon who gave a true and complete deſcription of them ; and, according to his account, they ſeem to have come originally from Bohemia †. The firſt correct figure of them is to be found in Marſigli ‡.

* *Spiegel-karpen*, cyprini quidam ſunt e Franconia, ſic dicti a maculis, p. 370.

† Carpiones regii, quod genus vix extra Bohemiam (in Moravia tamen aliquando, ſed a nobis advectum) inveneris. Duos habent ordines ſquamarum, quæ a capite ad caudam uſque trahuntur, cætera nudi ſunt ; ſquamæ in aureum colorem deſinunt ; jucundiſſimo quodam carnis ſapore præſtant cæteris. Sed ob teneritudinem diu non vivit, cum lorica illa ſquamea adverſus injurias minime defendantur. *Miſcellan. Bohem.* p. 126.

‡ Danub. vol. iv. p. 59. tab. 20.

CAMP-MILLS.

UNDER this appellation are underſtood portable or moveable mills, which can be uſed, particularly in the time of war, when there are neither wind- nor water-mills in the neighbourhood, and which on that account formerly accompanied armies in the ſame manner as camp-ovens and camp-forges. Some of theſe mills have ſtones for grinding the corn, and others are conſtructed with a notched roller like thoſe of our coffee-mills. Some of them alſo are ſo contrived, that the machinery is put in motion by the revolution of the wheels of the carriage on which they are placed; and others, and perhaps the greater part of thoſe uſed, are driven by horſes or men, after the wheels of the carriage are ſunk in the ground, or faſtened in ſome other manner.

To the latter kind belongs that mill of which Zonca * has given a coarſe engraving, but without any

* Novo teatro di machine ed edificii per varie et ſicure operationi, con le loro figure tagliate in rame, con la dichiaratione e dimoſtratione di ciaſcuno - - - di Vittorio Zonca, architetto della magnifica communita di Padoua. In Padoua appreſſo Franc. Bertelli, 1656, fol. This ſcarce book conſiſts of 115 pages, and contains

any deſcription. He ſays it was invented by Pompeo Targone, engineer to the well-known marquis Ambroſe Spinola; and he ſeems to place the time of the invention about the end of the ſixteenth century *. This mill is the ſame as that deſcribed by Beyer in his *Theatrum machinarum molarium*, and repreſented in the twenty-ſeventh plate of that work †. Beyer remarks that it was employed by Spinola.

The inventor, as his name ſhews, was an Italian, who made himſelf known, in particular, at the ce-

contains forty-two plates, beſides the title-page. The greater part of the machines delineated are engines for raiſing heavy bodies; but many of them are uſed in various trades and manufactures, and may ſerve in ſome meaſure to illuſtrate the hiſtory of them. The figures are coarſe and defective, and the deſcriptions, which are not altogether intelligible, contain only, for the moſt part, an account of the common conſtruction of each machine. By the preface it appears that the book was printed once before, in 1621.

* The figure of the mill has the following title: Nova inventione de' molini per macinare et condurre in guerra, inventati dal Sig. *Pompeo Targone*, ingegniero dell' eccellentiſſimo Sign. *Ambroſio Spinola*, generale per la maeſtà cattolica in Fiandra, dietro il numero ottantaotto. This figure is the only one in the work not particularly deſcribed.

† J. M. Beyer, Theatrum machinarum molarium, oder Schauplatz der Mühlen-Bau-kunſt. Leipzig 1735, fol. This work was reprinted at Dreſden in 1767, but without any additions, though promiſed in the title. Like figures alſo may be found in *Harſdorfers Philoſophiſchen und mathematiſchen erquickſtunden, dritter theil.* Nurnberg 1692, 4to. p. 437 and 658.

lebrated ſiege of Rochelle, under Louis XIII, at which he was choſen to aſſiſt, becauſe in the year 1603, when with Spinola, who was conſulted reſpecting the operations at Rochelle, he had helped by means of a mole to ſhut the harbour of Oſtend during the tedious ſiege of that place *. He was likewiſe in the French ſervice, as *intendant des machines du roi*; but his numerous and expenſive undertakings did not ſucceed according to his expectations †. He invented alſo a particular kind of gun-carriages, and a variety of warlike machines ‡.

Another old figure of ſuch a mill was ſhewn to me by profeſſor Meiſter, in *Recueil de pluſieurs machines militaires* ||, printed in 1620. This machine

* Toze, Geſchichte der Vereinigten Niederlande. Halle 1771, 2 theile, 4to. i. p. 496.

† All thoſe authors who have written expreſsly on the fate of the Huguenots, the hiſtory of Richelieu, Louis XIII, and the ſiege of Rochelle, make mention of Targone. See *Hiſtoire de Louis* XIII, *par Dupleix*. Paris 1643, fol. p. 235 and 323. This work forms the fourth part of *Hiſtoire générale de France, par Dupleix Hiſtoire de Louis* XIII, *par Le Vaſſor*. Amſterdam 1757, 4to ii. p. 505. iii. p. 159.

‡ Hiſtoire de la milice Françoiſe, par Daniel. Amſterdam 1724, 2 vol. 4to. i. p. 332.

|| Recueil de pluſieurs machines militaires et feux artificiel pour la guerre et recreation; avec l'Alphabet de Tritemius - - de la deligence de Franç. Thybourel et de Jean Appier. A Pont-a-Mouſſon 1620, 4to. Livre treiſième, p. 22.

was

was driven by the wheels of the carriage; but whether it was ever uſed, the author does not inform us.

Lancellotti * aſcribes this invention to the Germans, about the year 1633.

Carriages for tranſporting camp-forges and mill-machinery are mentioned by Leonard Fronſperger †, but he does not ſay whether complete mills were affixed to them.

* L' Hoggidi, overo gl'ingegni non inferiori a' paſſati; dell' abbate D. Secondo Lancellotti da Perugia, parte ſeconda, in Venetia 1636, 8vo. p. 457: Queſto anno (1633) s'intende de Germania una nuova inventione di molino ſopra un carro tirato da quatri cavalli, facile ad eſſere condotto per monti e valli, che caminando macina col giro delle ruote, e ſtando fermo macina come un molino a vento.

† Kriegſbuch, ander theil; von wagenburgk umb die veldleger. Frankfurt 1596, fol. p. 9.

MIRRORS*.

IT is highly probable that a limpid brook was the firſt mirror †, but we have reaſon to think that artificial mirrors were made as ſoon as mankind began to exerciſe their art and ingenuity on metals and ſtones. Every ſolid body, capable of receiving a fine poliſh, would be ſufficient for this purpoſe; and indeed, the oldeſt mirrors mentioned in hiſtory were of metal. Thoſe which occur in Job

* The works in which this ſubject has been already treated are the following:

Eberhartus de Weibe de ſpeculi origine, uſu et abuſu. A compilation formed without taſte, of which I gave ſome account in the Article on Chimneys.

Spanhemii Obſervationes in Callimachi hymnum in lavacrum Palladis, p. 615.

Meurſii Exercitationes criticæ, ii. 2. 6. In his Works, vol. v. p. 614. Contains only ſome paſſages from ancient authors.

Hiſtoire de l'Académie des Inſcriptions, tome xxiii. p. 140. *Recherches ſur les Miroirs des anciens, par Ménard.* A ſhort paper, barren of information.

Saggi di Diſſertazioni Accademiche lette nella nob. Accademia Etruſca dell' città di Cortona, 4to. tomo vii. p. 19: *Sopra gli ſpecchi degli antichi*, del Sig. Cari. A tranſlation from the French, with the figures of ſome ancient mirrors. It contains an explanation of ſome paſſages in Pliny, where he ſeems to ſpeak of a mirror formed of a ruby, and ſome conjectures reſpecting the mirror of Nero. An anonymous member of the academy, in

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Job ‡ are praiſed on account of their hardneſs and ſolidity; and Moſes relates ||, that the brazen laver, or waſhing-baſon, was made from the mirrors of the women who had aſſembled at the door of the tabernacle to preſent them, and which he cauſed them to deliver up. As the women appeared in full dreſs at divine worſhip, it was neceſſary for them to have looking-glaſſes after the

an apendix, confirms the former, and conſiders the latter very properly as improbable.

Recueil d'Antiquités (par Caylus), tome iii. p. 331, and tome v. p. 173. A deſcription and figures of ancient mirrors, with ſome chemical experiments on their compoſition.

Amuſemens Philoſophiques ſur diverſes parties des ſciences, et principalement de la phyſique et des mathematiques. Par le pere Bonaventure Abat. Amſterdam 1763, 8vo. p. 433: *Sur l'antiquité des mirroirs de verre.* A diſſertation worthy of being read on account of the author's acquaintance with the ancient writers, and his knowledge of technology; but he roves beyond all proof, and employs much verboſity to decorate his conjectures, which by their ornaments, however, acquire very little probability.

† Paſſages of the poets, where female deities and ſhepherdeſſes are repreſented as contemplating themſelves in water inſtead of a mirror, may be found collected by Gudius, Rigaltius and others, in the notes to *Phædri Fab.* i. 4, in the edition of Burmann, Amſtelodami 1698, 8vo. p. 19, 215, 408.

‡ Haſt thou with him ſpread out the ſky, which is ſtrong and as a molten looking-glaſs? Job, chap. xxxvii. ver. 18.

|| And he made the laver of braſs, and the foot of it of braſs, of the looking-glaſſes of the women aſſembling, which aſſembled at the door of the tabernacle of the congregation. Exodus, chap. xxxviii. ver. 8.

Egyptian manner. With theſe the waſhing-baſons, according to the conjecture of moſt interpretators, were only ornamented, covered, or perhaps hung round; and Michaelis * himſelf was

* Hiſtoria vitri apud Judæos, which may be found in *Commentar. Societat. ſcient. Gotting.* iv. p. 330. Having requeſted profeſſor Tychſen's opinion on this ſubject, I received the following anſwer: "You have conjectured very properly that the mirrors of the Iſraelitiſh women, mentioned Exod. xxxviii. 8, were not employed for ornamenting or covering the waſhing-baſons, in order that the prieſts might behold themſelves in them; but that they were melted, and baſons caſt of them. The former was a conceit firſt advanced, if I am not miſtaken, by Nicol. de Lyra, in the fourteenth century, and which Michaelis himſelf adopted in the year 1754; but he afterwards retracted his opinion when he made his tranſlation of the Old Teſtament at a riper age. In the Hebrew expreſſion there is no ground for it; and mirrors could hardly be placed very conveniently in a baſon employed for waſhing the feet. I muſt at the ſame time confeſs that the word (מראת) which is here ſuppoſed to ſignify a mirror, occurs no where elſe in that ſenſe. Another explanation therefore has been given, by which both the women and mirrors diſappear from the paſſage. It is by a learned Fleming, Hermann Gid. Clement, and may be found in his *Diſſertatio de labro aeneo*, Groning. 1732, and alſo in *Ugolini Theſaurus*, tom. xix. p. 1505, where it is quoted. He tranſlates the paſſage thus: Fecit labrum aeneum et operculum ejus aeneum cum *figuris ornantibus*, quæ ornabant oſtium tabernaculi. This explanation however is attended with very great difficulties; and as all the old tranſlators and Jewiſh commentators have here underſtood mirrors; and as the common tranſlation is perfectly agreeable to the language and circumſtances, we ought to believe that Moſes, not having copper, melted down the mirrors of his country women, and converted them into waſhing-baſons for the prieſts."

once

once of this opinion. But why ſhould we not rather believe that the mirrors were melted and formed into waſhing-baſons? As ſoon as mankind began to endeavour to make good mirrors of metal, they muſt have remarked, that every kind of metal was not equally proper for that uſe, and that the beſt could be obtained from a mixture of different metals. In the mirrors, however, which were collected by Moſes, the artiſts had a ſufficient ſtock of ſpeculum metal, and were not under the neceſſity of making it themſelves; and for this reaſon they could much more eaſily give to the whole baſon a poliſhed ſurface, in which the prieſts, when they waſhed, might ſurvey themſelves at full length. At any rate ſuch a baſon would not be the only one employed inſtead of a mirror. Artemidorus * ſays, that he who dreams of viewing himſelf in a baſon, will have a ſon born to him by his maid. Dreams indeed are generally as groundleſs as this interpretation; but one can hardly conjecture that Artemidorus would have thought of ſuch a dream, had it not been very common for people to contemplate themſelves in a baſon. There were formerly a kind of fortune-tellers, who pretended to ſhew in poliſhed baſons to the ſimple

* Oneirocrit. lib. iii. cap. 30. p. 176 : Λεκανη εγκατοπτριζεσθαι τεκνωσαι απο θεραπαινης σημαινει; pelvi vice ſpeculi uti, ex famula filios procreare ſignificat.

and ignorant, what they wiſhed to know *. The ancients alſo had drinking veſſels, the inſide of which was cut into mirrors, ſo diſpoſed, that the image of the perſon who drank from them was ſeen multiplied †. Vopiſcus mentions, among the valuable preſents of Valerian to the emperor Probus, when a tribune, a ſilver cup of great weight, which was covered in the inſide with mirrors of this ſort ‡.

Menard

* Specularios vocant, qui in corporibus lævigatis et terſis, ut ſunt lucidi enſes, pelves, cyathi, ſpeculorumque diverſa genera, divinantes curioſis conſultationibus ſatisfaciunt. *Joh. Sariſberienſis*, i. cap. 12.

† Quinetiam pocula ita figurantur, exſculptis intus crebris ceu ſpeculis, ut vel uno intuente populus totidem imaginum fiat. *Plin.* lib. xxxiii. cap. 9. p. 627. Seneca, ſpeaking of ſuch mirrors, uſes alſo the expreſſion *populus*. See his *Quæſt. nat.* i. cap. 5.

‡ Vita Probi, cap. iv. p. 926: Patinam argenteam librarum decem ſpecillatam. Saumáiſe chooſes rather to read *ſpecellatam*. I am inclined to think that this word ought to be read in Suetonius inſtead of *ſpeculatum*, where he ſpeaks of an apartment which Horace ſeems to have been fond of. That hiſtorian, in his Life of Horace, ſays: Ad res venereas intemperantior traditur. Nam *ſpeculato* cubiculo ſcorta dicitur habuiſſe diſpoſita, ut quocunque reſpexiſſet, ibi ei imago coitus referretur. Leſſing, who in his Miſcellanies (*Vermiſchten Schriften*, Berlin 1784, 12mo. iii. p. 205.) endeavours to vindicate the poet from this aſperſion, conſiders the expreſſion *ſpeculatum cubiculum*, if tranſlated *an apartment lined with mirrors*, as contrary to the Latin idiom, and thinks therefore that the whole paſſage is a forgery. Baxter alſo

Menard and others conjecture, that mirrors in the time of Homer were not much uſed, becauſe he mentions them on no occaſion, not even where he deſcribes in ſo circumſtantial a manner the toilet of Juno *. In anſwer to this, however, I have two things to obſerve. In the firſt place, it is not to be expected that Homer ſhould have mentioned every article with which he was acquainted; and, ſecondly, we are aſſured by Callimachus, where he evidently has imitated the before-quoted paſſage of Homer †, that neither Juno nor Pallas employed

alſo before ſaid, that this anecdote had been inſerted by ſome malicious impoſtor. This I will not venture to contradict, but I am of opinion that *ſpecillatum* or *ſpecellatum cubiculum* is at any rate as much agreeable to the Roman idiom as *patina ſpecillata*. This expreſſion Saumaiſe and Caſaubon have juſtified by ſimilar phraſes, ſuch as *opera filicata*, *teſſelata*, *hederata*, &c. The chamber in which Claudian makes Venus ornament herſelf, and be overcome by the perſuaſion of Cupid, was alſo covered over with mirrors, ſo that whichever way her eyes turned, ſhe could ſee her own image. *Hymn. in nupt. Honor. et Mariæ*, 117.

— — — — Speculi nec vultus egebat
Judicio; ſimilis tecto monſtratur in omni,
Et rapitur quocunque videt.

Did Claudian imagine that this goddeſs knew how to employ ſuch an apartment, not only for dreſſing, but even after ſhe was undreſſed, as well as Horace? I have ſeen at a certain court, a bed entirely covered in the inſide with mirrors.

* Iliad. lib. xiv. ver. 166.

† Hymnus in lavacrum Palladis, v. 15, 21. It was however cuſtomary

ed a mirror when they dreſſed. Mythology therefore did not allow the poet to introduce a mirror upon the toilet of that deity. Polydore Vergilius, Boccace, Menard, and others, have all fallen into the error of making Æſculapius the inventor of mirrors, though Cicero * ſeems to ſay the ſame thing; but the beſt commentators have long ſince obſerved very juſtly, that the Roman philoſopher alludes not to a mirror but to a probe, the invention of which we may allow to the father of medicine, who was at firſt only a ſurgeon.

When one reflects upon the uſe made of metal mirrors, particularly at Rome, to add to magnificence and for other purpoſes; and how many artiſts, during many ſucceſſive centuries, were employed in conſtructing them, and vied to excel each other in their art, one cannot help conjecturing that this branch of buſineſs muſt at thoſe periods have been carried to a high degree of perfection. It is therefore to be regretted, that they have not been par-

cuſtomary to aſcribe a mirror to Juno, as Spanheim on this paſſage proves; and Athanaſius, in *Orat. contra gentes*, cap. xviii. p. 18, ſays that ſhe was conſidered as the inventreſs of dreſs and all ornaments. Should not therefore the mirror, the principal inſtrument of dreſs, belong to her? May it not have been denied to her by Callimachus, becauſe he did not find it mentioned in the deſcription which Homer has given of her dreſſing-room?

* Æſculapiorum primus - - - - qui ſpecillum inveniſſe et primus vulnus obligaſſe dicitur. *De natur. Deorum*, iii. 22. Compare *Leſcoloperii Humanitas theolog.* p. 642.

ticularly

ticularly deſcribed by any writer, and that on this account the art was entirely loſt after the invention of glaſs-mirrors, which are much more convenient. No one at that time entertained the leaſt ſuſpicion, that circumſtances would afterwards occur which would render theſe metal-mirrors again neceſſary, as has been the caſe in our days by the invention of the teleſcope. Our artiſts then were obliged to make new experiments in order to diſcover the beſt mixture for mirrors of metal; and this ſhould be a warning to mankind, never to ſuffer arts which have been once invented and uſeful, to become again unknown. A circumſtantial deſcription of them ſhould at any rate be preſerved for the uſe of poſterity, in libraries, the archives of human knowledge.

When we compare metals in regard to their fitneſs for mirrors, we ſhall ſoon perceive that the hardeſt of a white colour poſſeſs in the higheſt degree the neceſſary luſtre. For this reaſon platina is preferable to all others, as is proved from the experiments made by the count von Sickingen. Steel approaches neareſt to this new metal, and ſilver follows ſteel; but gold, copper, tin, and lead are much leſs endowed with the requiſite property. I have however obſerved among the ancients no traces of ſteel-mirrors; and it is probable they did not make any of that metal, as it is ſo liable to become tarniſhed, or to contract ruſt. An

ancient

ancient ſteel-mirror is indeed ſaid to have been once found, but as ſome marks of ſilvering were perceived on it, a queſtion ariſes whether the ſilvered ſide was not properly the face of the mirror *. Beſides, every perſon knows that a ſteel mirror would not retain its luſtre many centuries amidſt ruins and rubbiſh.

The greater part of the ancient mirrors were made of ſilver, not on account of coſtlineſs and magnificence, as many think, but becauſe ſilver, as has been ſaid, was the fitteſt and the moſt durable of all the then known unmixed metals for that uſe. In the Roman code of laws, when ſilver plate is mentioned, under the heads of heirſhip and ſucceſſion by propinquity, ſilver mirrors are rarely omitted †; and Pliny ‡, Seneca ||, and other writers, who

* Speculum chalybeum, cujus diameter quinque pollices æquat; pars averſa leviter concava deargentata varia parerga habet. *Fortun. Licet. de lucernis antiq.* lib. vi. cap. 92. p. 1086. As this mirror was found near Nimeguen, I expected to ſee a better account of it in *Antiquitates Neomagenſes, ſive Notitia rerum antiquarum, quas comparavit Joh. Smetius;* Noviomagi 1678, 4to.: but I met with only the following paſſage, p. 149: Speculum chalybeum integrum, rotundum, convexum, cujus diameter pollicum quinque. Ad hæc innumera ſpeculorum chalybeorum, et in iis quorundam deauratorum fragmenta.

† Digeſt. lib. xxxiii. tit. 6, 3. In the Greek tranſlation, or Ecloga s Synopſis των βασιλικων, lib. xliv. tit. 9. cap. 3. p. 389, ſtands τα σπετλα του οικου; where, as Leunclavius has already remarked

who inveigh againſt luxury, tell us, ridiculing the extravagance of the age, that every young woman in their time muſt have a ſilver mirror. Theſe poliſhed ſilver plates may however have been very ſlight, for all the ancient mirrors, preſerved in collections, which I have ever ſeen, are only covered with a thin coat of that expenſive metal; and, in the like manner, our artiſts have at length learned a method of making the caſes of gold and ſilver watches ſo thin and light, that every footman and ſoldier can wear one. At firſt, the fineſt ſilver only was employed for theſe mirrors, becauſe it was imagined that they could not be made of that which was ſtandard; but afterwards metal was uſed of an inferior quality. Pliny tells us ſo expreſsly §, and I form the ſame concluſion from a

marked, p. 91, we ought to read σπικλα. This word can have no alluſion to windows, as theſe were not then in uſe. *Digeſta*, lib. xxxiv. tit. 2, 19, 8: Nec ſpeculum (argenteum) vel parieti affixum, vel etiam quod mulier mundi cauſſa habuit; ſi non in argenti numero habiti ſint. We find there alſo, lex xxv. 10, and in Synopſis βασιλικων, lib. xliv. tit. 15: το αργυρουν ισοπτρον.

‡ Plin. lib. xxxiv. cap. 17. p. 669: Argenteis ſpeculis uti cœpere et ancillæ.

‖ Jam libertinorum virgunculis in unum ſpeculum non ſufficit illa dos, quam dedit ſenatus pro Scipione. *Quæſt. nat.* at the end of the firſt book.

§ Laminas duci et ſpecula fieri non niſi ex optimo argento poſſe creditum fuerat. Id quoque jam fraude corrumpitur. Lib. xxxiii. c. 9. p. 626.

paſſage of Plautus *. Philematium having taken up a mirror, the prudent Scapha gives her a towel, and deſires her to wipe her fingers, leſt her lover ſhould ſuſpect by the ſmell, that ſhe had been receiving money. Fine ſilver however communicates as little ſmell to the fingers as gold; but it is to be remembered, that the ancients underſtood much better than the moderns how to diſcover the fineneſs of the noble metals by the ſmell, as many modes of proof which we uſe to find out the alloy, were to them unknown. Money-changers therefore employed their ſmell when they were deſirous of trying the purity of coin †. The witty thought of Veſpaſian, who, when reproached on account of his tax upon urine, deſired thoſe who did ſo to ſmell the money it produced, and to tell him whether it had any ſmell of the article which was the object of it, alludes to this circumſtance. In the like manner, many ſa-

* Sc. Cape igitur ſpeculum. - - - -
Linteum cape, atque exterge tibi manus.
Phi. Quid ita, obſecro?
Sc. Ut ſpeculum tenuiſti, ne oleant argentum manus;
Ne uſquam argentum te ſuſcepiſſe ſuſpicetur Philolaches.
Moſtell. act. i. ſc. 3. v. 101.

† Arrianus in Epictet. i. cap. 20. p. 79. Ὁ αργυρογνωμων προσχρηται κατα δοκιμασιαν του νομισματος τῃ ὀψει, τῃ ἁφῃ, τῃ οσφρασιᾳ. Argentarius ad explorationem numiſmatis utitur viſu, tactu, olfactu. - - - -

vage

vage nations, at preſent, can by their ſmell determine the purity of gold *.

We are informed by Pliny †, that Praxiteles, in the time of Pompey the Great, made the firſt ſilver mirror, and that mirrors of that metal were preferred to all others. Silver mirrors however

* I have already quoted proofs in my annotations on *Ariſtot. Auſcult. mirab.* p. 100; and *Antigoni Caryſt. Hiſt. mirab.* p. 234. The remaining paſſages of the ancients with which I am acquainted, where mention is made of ſilver mirrors, are the following: *Apuleius, in Apologia*, p. 424: Cur exiſtimes imaginem ſuam cuique viſendam potius in lapide, quam in argento? *that is* ſpeculo argenteo. The ſame author mentions in his *Floralia*, p. 790, among the valuables of Juno in the iſland of Samos: Plurima auri et argenti ratio in lancibus, ſpeculis, poculis et hujuſmodi utenſilibus. Κατοπτρον αργυρουν occurs among the rich articles conſecrated to Juno, in Philoſtratus, *Icon.* i. 6. p. 773. Chryſoſtome, *Serm.* xvii. p. 224, drawing a picture of the extravagance of the women, ſays: "The maid-ſervants muſt be continually importuning the ſilverſmith to know whether their lady's mirror be yet ready:" τοις αργυροκοποις συνεχως ερωτωντες, ει το κατοπτρον κατεσκευασθαι της κυριας. The beſt mirrors therefore were made by the ſilverſmiths. It appears however that the mirror-makers at Rome formed a particular company; at leaſt Muratori, in *Theſaur. inſcript. claſ.* vii. p. 529, has made known an inſcription in which *collegium ſpeculariorum* is mentioned. They occur alſo in *Codex Theodoſ.* xiii. tit. 4, 2. p. 57, where Ritter has quoted more paſſages in which they may be found. But perhaps the ſame name was given to thoſe who covered walls with poliſhed ſtones, and in later times to glaziers. In Greek they were called σπειλοποιοι.

† Prælata ſunt argentea. Primus fecit Praxiteles, Magni Pompeii ætate. Nuper credi cœptum, certiorem imaginem reddi, auro oppoſito averſis. *Lib.* xxxiii. cap. 9. p. 627.

were

were known long before that period, as is proved by the paſſage of Plautus above quoted. To reconcile this contradiction, Meurſius remarks that Pliny ſpeaks only of his countrymen, and not of the Greeks, who had ſuch articles much earlier, and the ſcene in Plautus is at Athens. This therefore ſeems to juſtify the account of Pliny, but of what he ſays afterwards I can find no explanation. Hardouin is of opinion, that mirrors, according to the neweſt invention, at that period, were covered behind with a plate of gold, as our mirrors are with an amalgam of metal. But as the ancient plates of ſilver were not tranſparent, how could the gold at the back part of them produce any effect in regard to the image? May not the meaning be, that a thin plate of gold was placed at ſome diſtance before the mirror in order to throw more light upon its ſurface? But whatever may have been the caſe, Pliny himſelf ſeems not to have had much confidence in the invention.

Mirrors of copper, braſs *, and gold †, I have found

* Callimach. in lavacrum Palladis, v. 21, calls the mirror of Venus διαυγεα χαλκον, nitidum æs. Two lines before he mentions alſo οξυχαλκον. Æſchylus, in *Stobæi Sermon. ethic.* xviii. p. 164, ſays, Braſs is the mirror of the countenance, and wine the mirror of the mind: κατοπτρον ειδους χαλκος. Nonnus, *Dionyſ.* v. p. 174, calls a mirror χαλκον διαυγεα, æs ſplendidum; and he repeats the ſame thing xlii. p. 1082.

† We find by Euripides, that Helen carried with her from Ilium

found mentioned only by the poets, who perhaps employed the names of theſe metals, becauſe they beſt ſuited their meaſure, or becauſe they wiſhed to uſe uncommon expreſſions, and thought a golden mirror the nobleſt. By the braſs ones perhaps are to be underſtood only ſuch as were made of mixed copper. Did golden mirrors occur oftener, I ſhould be inclined to refer the epithet rather to the frame or ornaments than to the mirror itſelf; for at preſent we ſay a gold watch, though the caſes only may be of that metal.

Mirrors ſeem for a long time to have been made of a mixture of copper and tin *, as is expreſsly ſaid

Ilium the golden mirror, χρυσεα ενοπτρα, παρθενων χαριτας, aurea ſpecula, virginum delicias. Hecuba, ver. 925. Seneca, *Quæſt. nat.* i. at the end, ſays: Poſtea, rerum jam potiente luxuria, ſpecula totis paria corporibus auro argentoque celata ſunt, denique gemmis adornata; et pluris unum ex his feminæ conſtitit, quam antiquarum dos fuit illa, quæ publice dabatur imperatorum pauperum filiabus. An tu exiſtimas, ex auro nitidum habuiſſe Scipionis filias ſpeculum, cum illis dos fuiſſet æs grave? Several manuſcripts however have *auro inditum;* and mirrors with golden frames are undoubtedly here meant. I know ſtill of another paſſage where mention is made of a gold mirror. It occurs in Ælian's *Var. hiſt.* lib. xii. cap. 58; but the words are ſo corrupted and unintelligible, that moſt commentators wiſh they were cleared up. Beſides, in other writers, who relate the ſame circumſtance, there is no mention of a mirror. The author perhaps alluded to a painting.

* Provided *ſtannum* always ſignifies tin, of which I have however

ſaid by Pliny *, who adds, that the beſt were conſtructed at Brundiſium. This mixture, which was known to Ariſtotle †, produces a white metal, which, on account of its colour, may have been extremely proper for the purpoſe, and even at preſent the ſame mixture, according to the careful experiments made by Mr. Mudge, an Engliſhman ‡, produces the beſt metal for ſpecula. It appears however that the ancients had not determined the proportion very accurately; for Pliny aſſures us twice, that in his time mirrors of ſilver were preferred. It is indeed not eaſy to aſcertain the quantity of each metal that ought to be taken, and the moſt advantageous degree of heat; upon which a great deal depends. One of the principal difficulties is to caſt the metal without bliſters or air-holes, and without reducing any part of the tin to a calx, which occaſions knots and cracks, and prevents it

ever ſome doubt. To determine this point, a reſearch would be neceſſary, which I have not yet been able to make. The *ſtannum* of the ancients is certainly ſometimes what the people at the German melting-houſes call *werk*, as I have proved in a note to *Ariſtot. Auſcult. mirabil.* p. 102.

* Optima ſpecula apud majores fuerunt Brundiſina, ſtanno et ære mixtis. Prælata ſunt argentea. *Lib.* xxxiii. c. 9. p. 627. Specula quoque ex ſtanno laudatiſſima, ut diximus, Brundiſii temperabantur, donec argenteis uti cœpere et ancillæ. *Lib.* xxxiv. c. 17. p. 669.

† Auſcultat. mirabil. cap. lxiii. p. 131.

‡ Philoſophical Tranſactions, vol. lxvii. p. 296.

from

from receiving a fine poliſh. A paſſage of Lucian *, which no one as yet has been able to clear up, alludes certainly, in my opinion, to theſe faults. A mixture of copper and tin is ſo brittle, that it is very liable to crack; and a mirror formed of it, if not preſerved with great care, ſoon becomes ſo dim, that it cannot be uſed till it has been previouſly cleaned and poliſhed. For this reaſon a ſponge with pounded pumice-ſtone was generally ſuſpended from the ancient mirrors †, and they

* Quomodo hiſtoria ſit conſcrib. cap. 51. Edition of Deux-Ponts, iv. p. 210, 535: Μαλιστα δε κατοπτρω εοικυιαν παρασχεσθω την γνωμην, αθολω και σιλπνω, και ακριβει το κεντρον.. Maxime vero ſpeculo ſimilem præbeat animum, nihil turbido, et ſplendido, et centri exacti; qualeſque acceperit operum ſpecies, tales etiam illas oſtendat; perverſum vero, aut alieni coloris, aut figuræ diverſæ, nihil. Commentators have found no other way to explain κεντρον than by the word *centre*, to which, according to their own account, there can be here no alluſion. In my opinion κεντρον ſignifies thoſe faulty places which are not capable of a complete poliſh, on account of the knots or cracks which are found in them. Lucian therefore ſpeaks of a faultleſs mirror which repreſents the image perfect, as he afterwards informs us. This meaning of the term *centrum* I have proved already in a note to the article on Ultramarine. See *Salmaſii Exercitat. Plin.* p. 756.

† The paſſages which ſerve to prove this circumſtance have been quoted by Voſſius in his Annotations on Catullus, p. 97, and after him by Spanheim on Callimachus, p. 622. Plato in *Timæus*, according to the edition of Stephanus, t. iii. p. 72, ſays: Tanquam ſpongia parata et prompta detergendo, cui appoſita eſt, ſpeculo. In Tertullian *De pallio*, Omphale rubs the blood from an arrow with the pumice-ſtone which was uſed for cleaning a mirror. Heſychius explains νεοσμηκτον εσοπτρον by το νεως καθαρθεν κατοπτρον, a mirror newly cleaned.

were kept likewiſe in a caſe or box, as may be ſeen by the greater part of thoſe ſtill extant. Mirrors of ſilver were leſs ſubject to this inconvenience, and I am inclined to think that the latter on this account made the former be diſuſed, as we are informed by Pliny.

As ancient mirrors of metal are ſtill to be found in collections of antiquities, it might be of ſome importance to the arts, if chemical experiments were made on their compoſition. Thoſe who have hitherto given us any account of them have contented themſelves with deſcribing their external figure and ſhape. Count Caylus * is the only perſon,

* As the account of theſe experiments is given in an expenſive work, which may not often fall into the hands of thoſe who are beſt able to examine it, I flatter myſelf that I ſhall receive thanks for inſerting it here. "The ancient mirror which I examined, was a metallic mixture, very tender and brittle, and of a whitiſh colour inclining to grey. When put into the fire, it remained a long time in a ſtate of ignition before it melted. It was neither inflammable nor emitted any ſmell like garlic, which would have been the caſe had it contained arſenic. It did not either produce thoſe flowers which are generally produced by all mixtures in which there is zinc. Beſides, the baſis of this mixture being copper, it would have been of a yellow colour had that ſemi-metal formed a part of it. I took two drams of it and diſſolved them in the nitrous acid. A ſolution was ſpeedily formed, which aſſumed the ſame colour as ſolutions of copper. It precipitated a white powder, which I carefully edulcorated and dried. Having put it into a crucible with a reductive flux, I obtained lead very ſoft and malleable.

"Having

ſon, as far as I know, who cauſed any chemical experiments to be undertaken on this ſubject. They were made on a mirror found near Naples,

"Having filtered the ſolution, I took a part of it, upon which I poured an infuſion of gall-nuts, but it produced no change. A ſolution of gold, which I poured upon another part, made it aſſume a beautiful green colour; but no precipitate was formed: which is ſufficient to prove that there was neither iron nor tin in the mixture.

"On the remaining part of the ſolution I poured a ſufficient quantity of the volatile alkali to diſſolve all the copper that might be contained in it. The ſolution became of a beautiful ſapphire-blue colour, and a white precipitate was formed. Having decanted the liquor, and carefully edulcorated the precipitate, I endeavoured to reduce it; but whether it was owing to the quantity being too ſmall, or to my not giving it ſufficient heat, I could not ſucceed. I had recourſe therefore to another method.

"I took the weight of two drams of the mixture, which I brought to a high ſtate of ignition in a cuppel. When it was of a whitiſh-red colour, I threw upon it gradually four drams of ſulphur, and when the flame ceaſed, I ſtrengthened the fire in order to bring it to complete fuſion. By theſe means I obtained a tender brittle regulus, whiter than the mixture, in which I obſerved a few ſmall needles. Being apprehenſive that ſome copper might ſtill remain, I ſulphurated it a ſecond time, and then obtained a ſmall regulus which was almoſt pure antimony.

"It reſults from theſe experiments, that the metal of which the ancients made their mirrors was a compoſition of copper, regulus of antimony, and lead. Copper was the predominant, and lead the ſmalleſt part of the mixture; but it is very difficult, as is well known, to determine with any certainty the exact proportion of the ſubſtances contained in ſuch compoſitions."

by Mr. Roux, who aſſerts that the compoſition was a mixture of copper and regulus of antimony, with a little lead. Antimony however was not known to the ancients. If that metal was really a component part, the mirror muſt have been the work of more modern times, or it muſt be allowed that the artiſt had metal combined with antimony without knowing it; but the latter is not probable. The experiments however made by Roux do not ſeem to me to have proved in a ſatisfactory manner the preſence of regulus of antimony; and for this reaſon I requeſted the opinion of Mr. Gmelin, which I here inſert with his permiſſion.

" According to the account given of the expe-
" riments, which were however incomplete, I
" think it probable that the metal of the mirror
" contained antimony; but it is much to be wiſh-
" ed that the author had not confined himſelf
" merely to relate that he obtained a white tender
" brittle regulus, with a few metallic needles; and
" that he had carried his proofs farther, and ſhewn
" that it could be nothing elſe than metallic par-
" ticles of antimony. This regulus, at any rate,
" cannot have been tin, which is not brittle, and
" which readily becomes yellow by ſulphur; nor
" iron, which would have become darker, and
" which in general unites ſooner with ſulphur
" than copper; nor could it have been manganeſe,
" which ſometimes cannot be eaſily melted by ſuch
" a fire,

" a fire, even with the addition of ſulphur, and
" which ſometimes will not diſſolve in the vitriolic
" acid.

" In ſhort, I am not convinced that the mixture
" contained no tin. As it diſſolved very ſpeedily,
" it appears to me highly probable, that the white
" calx, which was in the mean time precipitated,
" was, in part, and perhaps principally, calx
" of zink; and that the pretended lead was, for
" the greater part, tin. A portion of the tin
" may, indeed, have been diſſolved in the acid;
" for, though a purple calx was not precipitated
" by the ſolution of gold, that proves nothing.
" According to every appearance the acid was
" far from being ſaturated, and with a ſolu-
" tion of tin ſo little ſaturated a ſolution of gold
" will as little produce a diſtinguiſhable purple,
" as an infuſion of gall-nuts will a precipitate."

No certain information can be derived from theſe experiments, for the antiquity of the mirror was not aſcertained; nor was it known whether it ought to be reckoned among the beſt or the worſt of the period when it was made.

Thoſe mirrors, which were ſo large that one could ſee one's ſelf in them at full length, muſt, in all probability, have conſiſted of poliſhed plates of ſilver; for, to caſt plates of ſuch a ſize of copper

and tin would have required more art than we can allow to thoſe periods; and I do not know whether our artiſts even would ſucceed in them *.

We read in various authors that, beſides metals, the ancients formed ſtones into mirrors, which were likewiſe in uſe. It is undoubtedly certain that many ſtones, particularly of the vitreous kind, which are opake and of a dark colour, would anſwer exceedingly well for that purpoſe; but let the choice have been ever ſo good, they would not, in this reſpect, have been nearly equal to metals. Theſe of all mineral bodies have the moſt perfect opacity; and for that reaſon the greateſt luſtre: both theſe properties are produced by their ſolidity; and hence they reflect more perfectly, and with more regularity, the rays of light that proceed from other bodies. Our glaſs mirrors, indeed, are properly metallic. Stones, on the other hand, have, at any rate, ſome, though often hardly perceptible, tranſparency; ſo that many of the rays of light are abſorbed, or at leaſt not reflected. Mention of ſtone mirrors occurs alſo ſo ſeldom in the ancients, that we may conclude they were made rather for ornament than

* Of ſuch large mirrors Seneca ſpeaks in his *Quæſt. nat.* lib. i. Of the like kind was the mirror of Demoſthenes mentioned by Plutarch, Lucian, and Quintilian. *Inſtitut. orat.* xi. 3, 68. p. 572: Grande quoddam intuens ſpeculum, componere actionem ſolebat.

real

real utility. In general, we find accounts only of poliſhed plates or pannels of ſtone, fixed in the walls of wainſcoted apartments, which were celebrated on account of their property of reflection.

Pliny* praiſes in this reſpect the obſidian ſtone, or, as it is now called, the Icelandic agate. Every thing that he ſays of it will be perfectly intelligible to thoſe who are acquainted with this ſpecies of ſtone or vitrified lava. The image reflected from a box made of it, that I have in my poſſeſſion, is like a ſhadow or ſilhouette; but with this difference, that one ſees not only the contour, but alſo the whole figure diſtinctly, though the colors are darkened. To form it into images and utenſils, which Pliny ſpeaks of, muſt have been exceedingly difficult, on account of its brittleneſs. I ſaw at Copenhagen, among other things made of it, a drinking-cup and cover, on which the artiſt had been employed four years.

Domitian, when he ſuſpected that plots were formed againſt him, cauſed a gallery, in which he

* In genere vitri et obſidiana numerantur, ad ſimilitudinem lapidis, quem in Æthiopia invenit Obſidius, nigerrimi coloris, aliquando et tranſlucidi, craſſiore viſu, atque in ſpeculis parietum pro imagine umbras reddente. *Lib.* xxxvi. c. 26. p. 758. The latter part of this paſſage is twice repeated by Iſidore in his *Origin.* 16, 15, and 4. In one of theſe places he ſays: Ponitur in ſpeculis parietum, propter imaginum umbras reddendas.

uſed

uſed to walk, to be lined with *phengites*, which by its reflection ſhewed every thing that was done behind his back*. Under that appellation we are undoubtedly to underſtand a calcareous or gypſeous ſpar, or ſelenite, which is indeed capable of reflecting an image; but we cannot therefore pretend to ſay that the ancients formed mirrors of it; nor do I explain what Pliny ſays, where he ſpeaks of the *phengites*, as if whole buildings had been once conſtructed of it†. That kind of ſtone, for various reaſons, and particularly on account of its brittleneſs, is altogether unfit for ſuch a purpoſe. At thoſe periods, the windows of houſes were open, and not filled up with any

* Tempore ſuſpecti periculi adpropinquante, ſollicitior in dies, porticuum, in quibus ſpatiari conſueverat, parietes phengite lapide diſtinxit, e cujus ſplendore, per imagines, quidquid a tergo fieret, provideret. *Suton. in Vita Domit.* cap. xiv. p. 334.

† In Cappadocia repertus eſt lapis duritia marmoris, candidus atque tranſlucens, etiam qua parte fulvæ inciderant venæ, ex argumento phengites appellatus. Hoc conſtruxerat ædem Fortunæ, quam Sciam appellant a Servio rege factatam, aurea domo complexus. Quare etiam foribus apertis interdiu claritas ibi diurna erat, alio quam ſpecularium modo, tanquam incluſa luce. *Lib.* xxxvi. 22. p. 752.

Cappadociæ lapis, duritia marmoris, candidus atque tranſlucidus, ex quo quondam templum conſtructum eſt a quodam rege, foribus aureis, quibus clauſis claritas diurna erat. *Iſidor. Origin*, 16, 4. Our ſpar is tranſparent, though clouds and veins occur in it, like, for example, the violet and iſabella-coloured of that found at Andreasberg. Compare this explanation with what Saumaiſe ſays in *Exercitat. Plin.* p. 184.

tranſparent

tranſparent ſubſtance, but only covered, ſometimes, by lattices or curtains. It is probable, therefore, that thoſe openings of the walls of the building mentioned by Pliny, where the windows uſed to be, were filled up with *phengites*, which, by admitting a faint light, prevented the place from being dark even when the doors were ſhut; ſo that Pliny might ſay, "it appeared as if "the light did not fall into the building, but as "if it were incloſed in it."

I might be accuſed of omiſſion did I not here mention alſo a paſſage of Pliny *, where he ſeems to ſpeak of a mirror made of an emerald, which Nero uſed to aſſiſt him to ſee the combats of the gladiators. Cary aſſerts, that Nero was ſhort-ſighted, and that his emerald was formed like a concave lens. The former is expreſsly ſaid by Pliny †, but the latter, though by Abat conſidered not improbable ‡, I can ſcarcely allow myſelf to

* Smaragdi plerumque et concavi, ut viſum colligant. Quapropter decreto hominum iis parcitur, ſcalpi vetitis. Quamquam Scythicorum Ægyptiorumque duritia tanta eſt, ut nequeant vulnerari. Quorum vero corpus extenſum eſt, eadem, qua ſpecula, ratione, ſupini imagines rerum reddunt. Nero princeps gladiatorum pugnas ſpectabat ſmaragdo. *Lib.* xxxvii. cap. 5. p. 774.

† Neroni, niſi cum conniveret, ad prope admota hebetes (oculi). *Lib.* xi. cap. 37. p. 617.

‡ This diſſertation of Abat may be found tranſlated in *Neuen Hamburg. Magazin.* i. p. 568.

believe,

believe, becauſe ſuch an interpretation of Pliny's words is too forced, and becauſe they can be explained much better in another manner. As no mention of ſuch an excellent help to ſhort-ſighted people is to be found in any other ancient author, we muſt allow, if Cary's opinion be adopted, that this property of the concave emerald was caſually remarked, and that no experiments were made to cut any other natural or artificial glaſs in the ſame form for the like uſe, becauſe people imagined that this property was peculiar to the emerald alone, which was then commonly ſuppoſed to be endowed with the power of greatly ſtrengthening the eye-ſight. Much more probable to me is the explanation of an Italian, which Abat alſo does not entirely reject, that the emerald had a ſmooth poliſhed ſurface, and ſerved Nero as a mirror *; and the paſſage of Pliny alluded to ſeems to have been thus underſtood by Iſidore † and Marbo-

* La ſoſtanza è, che ſecondo il racconto di Plinio, lo ſpecchio uſato da Nerone non era nè concavo nè occhialino, ma ſpecchio grande e lontano dall' occhio, e poſto obliquamente ſul terrazino, e fineſtra - - - Dunque lo ſmeraldo uſato da Nerone era di corpo, o mole eſteſa, grande e piana, e collocavaſi ſupino o ſia inclinato, perchè vi ſi imprimeſſero, e rifletteſſero le imagini, come negli altri ſpecchi, e perciò non ſi è fondamento alcuno per crederlo occhialino. Almeno Plinio dice il contrario. *Academia di Cortona*, vii. p. 34.

† Cujus corpus ſi extenſum fuerit, ſicut ſpeculum, ita imagines reddit. Quippe Nero Cæſar gladiatorum pugnas in ſmaragdo ſpectabat. *Origin.* xvi. 7.

dæus. It may here be objected, that real emeralds are too ſmall to admit of being uſed as mirrors; but the ancients ſpeak of ſome ſufficiently large for that purpoſe, and alſo of artificial ones *; ſo that we may with certainty conclude, that they claſſed among the emeralds ſparry fluor, green vitrified lava, or the green Icelandic agate as it is called, green jaſper, and alſo green glaſs. The piece of green glaſs in the monaſtery of Reichenau, which is ſeven inches in length, three inches in thickneſs, and weighs twenty-eight pounds three quarters †; and the large cup at Genoa, which is, however, full of flaws ‡, have been given out to be emeralds even to the preſent time.

Mirrors were made alſo of rubies, as we are aſſured by Pliny§, who refers to Theophraſtus for his authority; but this precious ſtone is never found now of ſuch a ſize as to render this uſe poſ-

* Goguet, Urſprung der geſetze und künſte, ii. p. 111. *Fabricii Biblioth. Græca*, vol. i. p. 70.

† Keyſsler's Reiſen, i. p. 17. *Andrea, Briefe aus der Schweiz.* Zurich 1776, 4to. p. 47, and alſo p. 65, where may be ſeen H. Von Beroldingen's opinion reſpecting this emerald.

‡ Keyſsler, i. p. 441. *Mercure de France.* Août, 1757. p. 149.

§ Naſcuntur (carbunculi) et in Thracia coloris ejuſdem, ignem minime ſentientes. Theophraſtus auctor eſt, et in Orchomeno Arcadiæ inveniri, et in Chio. Illos nigriores, e quibus et ſpecula fieri. *Lib.* xxxvii. cap. 7. p. 779.

ſible;

ſible; and Cary and the anonymous Italian before mentioned have proved very properly that Pliny has committed a groſs miſtake, which has not been obſerved by Hardouin. Theophraſtus, in the paſſage alluded to *, does not ſpeak of a ruby, but of the well-known black marble of Chio, though he calls both *carbunculus* †, a name given to the ruby on account of its likeneſs to a burning coal, and to the black marble on account of its likeneſs to a quenched coal or cinder; and the latter, as well as the obſidian ſtone, was uſed ſometimes for mirrors.

The account how mirrors were formed by the native Americans, before they had the misfortune to become acquainted with the Europeans, is of conſiderable importance in the hiſtory of this art. Theſe people had indeed mirrors which the Europeans could not help admiring. Some of them were made of black, ſomewhat tranſparent, vitrified lava, called by the Spaniards *gallinazo*, and which is of the ſame kind as the obſidian ſtone employed by the Romans for the like purpoſe.

* Αἱ δὲ δὴ ἐκ τῆς Ἑλλάδος, εὐτελέσταται. οἷον τὸ ἀνθρακῖνον τὸ ἐξ Ὀρχομενοῦ τῆς Ἀρκαδίας. ἐστὶ δ' οὗτος μελάντερος τοῦ Χίου, κατοπτρα δ' ἐξ αὐτοῦ ποιοῦσι. Quæ naſcuntur in Græcia, viliſſimæ; uti carbunculus ex Orchomeno Arcadiæ: eſt autem iſte nigrior Chio (marmore); ſpecula autem ex illo fiunt. *De lapid.* § 61.

† Ἀνθρακες, Ἀνθρακα.

Of

Of this ſubſtance the Americans had plane, concave, and convex mirrors. They had others alſo made of a mineral called the Inca's ſtone*, which, as has been already ſaid by Bomare, Sage, Wallerius, and other mineralogiſts †, was a compact pyrites or marcaſite, ſuſceptible of a fine poliſh; and on that account often brought to Europe, and worn formerly in rings under the name of the ſtone of health. Ulloa ſays the Inca's ſtone is brittle, opake, and of a ſomewhat blueiſh colour; it has often veins which cannot be poliſhed, and where theſe veins are it frequently breaks. The mirrors formed of it, which he ſaw, were from two to three inches in diameter; but he ſaw one which was two feet and a half. The opinion which ſome have entertained that theſe mirrors were caſt, has no other foundation than the likeneſs of poliſhed marcaſite to caſt braſs. This mineral is

* Anton. de Ulloa, in his Voyage, according to the German tranſlation, which makes the ninth volume of *Der Algemeinen hiſtorie der reiſen*, p. 343.

† Bomare, Mineralogie, ii. p. 15 and 159. *Sage, Mineralogie.* Leipz. 1775, 8vo, p. 230. *Wallerii Syſtema mineralog.* ii. p. 133. *Gmelin, Naturſyſtem des mineralreichs, nach Linné.* Nurnberg. 1778. 8vo. ii. p. 489. *Recherches ſur les Americains,* par Paw, ii. p. 184. Quant à la pierre des Incas, c'eſt une eſpece de pyrite blanche, arſenicale, luiſante comme de l'étain, ou du fer recuit, dont l'analogue eſt inconnu dans notre continent.—The laſt aſſertion, however, is undoubtedly falſe.

[This ſtone acquired its name from its being much uſed in ornaments by the Incas or Princes of Peru. TRANS.]

very

very proper for reflecting images; and I am inclined to think that the Peruvians had better mirrors than the Greeks or the Romans, among whom we find no traces of marcasite being employed in that manner. It appears, however, that the former had mirrors also of silver, copper, and brass *.

I come now to the question in what century were invented our glass mirrors, which consist of a glass plate covered at the back with a thin leaf of metal. This question has been answered by some with so much confidence, that one might almost consider the point to be determined; but instead of real proofs we find only conjectures or probabilities; and I must here remark, that I cannot help thinking that they are older than has hitherto been supposed, however desirous I may be to separate historical truth from conjecture. When I have brought together every thing that I know on the subject, I would say, that attempts were even made at Sidon to form mirrors of glass; but that they must have been inferior to those of metal, because they did not banish the use of the latter. The first glass mirrors appear to me to have been of black-coloured glass, or an imitation of the obsidian stone; and to have been formed afterwards of a glass plate with some black

* De la Vega, ii. 28.

foil

foil placed behind it *. At a much later period, blown glaſs, while hot, was covered in the inſide with lead or ſome metallic mixture; and ſtill later, and, as appears, firſt at Murano, artiſts began to cover plates of glaſs with an amalgam of tin and quickſilver. The neweſt improvements are, the caſting of glaſs-plates, and the art of making plates equally large by blowing and ſtretching, without the expenſive and uncertain proceſs which is required for caſting.

That glaſs mirrors were made at the celebrated glaſs-houſes of Sidon, is mentioned ſo clearly by Pliny that it cannot be doubted †. When I read the paſſage, however, without prejudice, without thinking of what others have ſaid on it already, and compare it with what certain information the ancients, in my opinion, give on the ſame ſubject, I can underſtand it no otherwiſe than as if the author ſaid, that the art of manufacturing glaſs various ways was invented, principally, at Sidon, where attempts had been made to form

* Montamy in *Abhandlung von den farben zum porzellan*, Leipzig 1767, 8vo. p. 222, aſſerts that he ſaw, in a collection of antiquities, glaſs mirrors which were covered behind only with a black foil.

† Aliud vitrum flatu figuratur, aliud torno teritur, aliud argenti modo cælatur, Sidone, quondam iis officinis nobili, ſiquidem etiam ſpecula excogitaverat. Hæc fuit antiqua ratio vitri. *Lib.* xxxvi. cap. 26, p. 758.

mirrors of it. He appears therefore to allude to experiments which had not completely ſucceeded; and to ſay that ſuch attempts, at the time when he wrote, had been entirely abandoned and were almoſt forgotten. Had this circumſtance formed an epoch in the art, Pliny, in another place, where he deſcribes the various improvements of it ſo fully, would not have omitted it; but of thoſe experiments he makes no farther mention *. All the inventions which he ſpeaks of, evidently relate to metal mirrors only, of which the ſilver, at that time, were the neweſt. Had the Sidonian mirrors conſiſted of glaſs plates covered at the back, thoſe of metal, the making of which was, at any rate, attended with no leſs trouble, which were more inconvenient for uſe on account of their aptneſs to break, their requiring to be frequently cleaned and preſerved in a caſe, and which were more unpleaſant on account of the faint, dull image which they reflected, could not poſſibly have continued ſo long in uſe as they really did; and circumſtances and expreſſions relative to glaſs mirrors muſt certainly have occurred. Though glaſs continued long to be held in high eſtimation, particularly at Rome; and though many kinds of glaſs-ware are mentioned

* Atque ut omnia de ſpeculis peraguntur hoc loco, optima apud majores fuerunt Brundiſina, ſtanno et ære mixtis. Prælata ſunt argentea. *Lib.* xxxiii. cap. 9, p. 627.

in

in ancient authors, among coſtly pieces of furniture, mirrors are mentioned only among articles of ſilver plate. I am acquainted with no certain trace of glaſs mirrors from the time of Pliny to the thirteenth century; but after that period, at which they are ſpoken of in the cleareſt manner, we find them often mentioned in every century; and mirrors of metal at length entirely diſappear.

How the Sidonian mirrors were made, is not known; but if I may be allowed a conjecture, I am of opinion that they conſiſted of dark-coloured glaſs, which had a reſemblance to the obſidian ſtone. Such is the uſual progreſs of inventions. At thoſe periods one had no other repreſentation of glaſs mirrors than that afforded by natural glaſs or vitreous ſtones. When artiſts wiſhed to make mirrors of glaſs, they would try to imitate the latter. After the invention of printing, people endeavoured to render printed books as like as poſſible to manuſcripts; becauſe they imagined that this invention was to be approved only ſo far as it enabled them to imitate theſe, without obſerving that it could far excell the art of writing. The Sidonian mirrors, therefore, were ſo far excelled by the ſilver or braſs mirrors, which perhaps were invented about the ſame time, that on this account they were never brought into uſe. Glaſs mirrors, perhaps, would have been invented ſooner, had mankind employed at an earlier period glaſs-win-

dows, which often, when they are ſhut on the outſide ſo that no light can paſs through them, reflect images in a much better manner than the beſt mirrors of metal. This obſervation, which may be made daily, would then, in all probability, have been ſooner turned to advantage.

No one has employed a greater profuſion of words to maintain an opinion oppoſite to mine than Abat; but when his proofs are diveſted of their ornaments, they appear ſo weak that one has very little inclination to agree with him. "The obſervation," ſays he, "that a plate of glaſs is the beſt mirror, when all other rays of light, except thoſe reflected back from the glaſs, are prevented, by a metallic covering placed behind it, from falling on the eye, is ſo eaſy, that it muſt have been made immediately after the invention of glaſs." Who does not think here of Columbus and his egg? Inſtances occur in hiſtory of many having approached ſo near an invention, that we are aſtoniſhed how they could have miſſed it; ſo that we may exclaim with a certain Emperor, *Taurum toties non ferire difficile eſt* *. "The

* Fuit præterea idem ingenioſiſſimus: cujus oſtendentia acumen pauca libet ponere. Nam cum taurum ingentem in arenam miſiſſet, exiſſetque ad eum feriendum venator, neque perductum decies potuiſſet occidere, coronam venatori miſit; muſſantibuſque cunctis, quid rei eſſet, quod homo ineptiſſimus coronaretur, ille per curionem dici juſſit, *Taurum toties non ferire difficile eſt.* Trebell. Pollio, Vita Galien. cap. 12.

Sidonian

Sidonian invention," continues he, "would not have been worth mentioning had it not produced better mirrors than thoſe which the ancients had before of the obſidian ſtone. But theſe even are mentioned only once, in ſo ſhort and abrupt a manner, and as it were out of ridicule, that one may eaſily perceive they were not much eſteemed." "If the Sidonians," adds he, "were not the inventors, let ſome other inventor be mentioned;" and he aſſures us that he had ſought information on this ſubject, in Neri, Kunkel, and Merret, but without ſucceſs. That I believe; but Abat does not remark that by the ſame manner of reaſoning we may aſcribe to the Sidonians the invention of watches, and many other articles, the inventors of which are not to be found in books where they ought as much to be expected as the inventor of glaſs in Neri. The grounds on which many old commentators of the bible, Nicholas de Lyra and others, have ſuppoſed that glaſs mirrors were known ſo early as the time of Moſes, are ſtill weaker. If quoting the names of writers who entertain a like opinion be of any weight, I could produce a much greater number of learned men, who, after an expreſs examination of the queſtion, deny altogether that glaſs mirrors were uſed by the ancients.

Dr. Watſon *, alſo, has endeavoured to ſupport

* Chemical Eſſays. Cambridge 1786, vol. iv. p. 246.

the opinon of Abat, but with leſs confidence and with more critical acumen. His grounds, I think, I have weakened already; but one obſervation here deſerves not to be over-looked, becauſe it ſuggeſts an idea that may ſerve to illuſtrate a paſſage of Pliny *, which, as I before remarked, has never yet been explained. If we admit, ſays he, that Pliny was acquainted with glaſs mirrors, we may thus underſtand what he ſays reſpecting an invention, which was then new, of applying gold behind a mirror. Inſtead of an amalgam of tin, ſome one had propoſed to cover the back of the mirror with an amalgam of gold, with which the ancients were certainly acquainted, and which they employed in gilding †. He mentions, alſo, on this occaſion, that a thought had once occurred to Buffon, that an amalgam of gold might be much better for mirrors than that uſed at preſent ‡. This conjecture appears, at any rate, to be ingenious; but when I read the paſſage again, without prejudice, I can hardly believe that Pliny al-

* Nuper credi cœptum, certiorem imaginem reddi auro appoſito averſis. *Lib.* xxx. cap. 9, p. 627.

† Plin. lib. xxxiii: Æs inaurari argento vivo, aut certe hydrargyro, legitimum erat. The firſt name here ſeems to ſignify native quickſilver, and the ſecond that ſeparated from the ore by an artificial proceſs.

‡ On pourroit trouver le moyen de faire un meilleur étamage, et je crois qu'on parviendroit en employant de l'or et du vifargent. *Hiſt. nat. ſupplem.* i. p. 451.

ludes

ludes to a plate of glaſs in a place where he ſpeaks only of metalline mirrors; and the over laying with amalgam requires too much art to allow me to aſcribe it to ſuch a period without ſufficient proof. I conſider it more probable that ſome perſon had tried, by means of a poliſhed plate of gold, to collect the rays of light, and to throw them either on the mirror or the object, in order to render the image brighter.

Profeſſor Heeren ſhewed me a paſſage in the Ecloga of Stobæus,[3] which, on the firſt view, ſeems to allude to a glaſs mirror *. That author ſays, Philolaus the Pythagorean believed that the ſun was a vitreous body, which only received the rays of the ethereal fire and reflected them to us like a mirror. When we compare, however, the words of Stobæus with thoſe by which Plutarch †, Achilles Tatius ‡, Euſebius § and others, expreſs

* Φιλολαος ὁ Πυθαγορειος, ἰαλοειδη τον ἡλιον, δεχομενον μεν του εν τῳ κοσμῳ πυρος την αντανγειαν, διηθουντα δε προς ἡμας το τε φως και την αλεαν, ὡσε τροπον τινα διττους ἡλιους γιγνεσθαι, το, τε εν τῳ ουρανῳ πυρωδες, και το απ' αυτου πυροειδες κατα το εσοπτροειδες· ει μη τις και τριτον λεξει την απο του ενοπτρου κατ' ανακλασιν διασπειρομενην προς ἡμας αυγην. Philolaus vitreæ naturæ ſolem fecit, qui ut cœleſtis ignis radios reciperet, ita lumen ſimul cum calore ad nos transfunderet; ſic ut duo quodam pacto ſint ſoles, nempe cœleſtis ignis, et qui inde tanquam in ſpeculum transfunditur; niſi quis etiam tertium velit addere, radium a ſpeculo ad nos reflexum. *Stob. Eclog.* edit. Antverp. 1575. fol. p. 56.

† De placitis philoſoph. ii. cap. 20.

‡ Iſagoge in Aratum, cap. 19.

§ Lib. i. cap. 8.

the ſame thing, that meaning cannot be drawn from them. It appears, at firſt, as if Philolaus had conſidered the ſun to be tranſparent, and ſuppoſed that the rays paſſed through it, and came condenſed to our earth, in the ſame manner as they are brought to a focus by a glaſs globe. Some commentators have explained the paſſage in this manner; and on account of the affinity of the Greek words have thought alſo of a funnel. In that caſe, however, the compariſon of the ſun with a mirror could not have been juſt; and if it be admitted that Philolaus conſidered the ſun as a bright body endowed with the property of reflection, what he ſays of rays paſſing or tranſmitted through it, and of the pores of the ſun's body, will become unintelligible. But even if we adopt the laſt explanation, that Philolaus imagined the ſun to be a mirror, it does not follow that he had any idea of a glaſs one *; and, beſides, he only ſpeaks of a body capable of reflecting a ſtrong light; and that glaſs, under certain circumſtances, is fit for that purpoſe, may have been remarked as ſoon as it was invented, though men might not find out the art of forming it into proper mirrors by

* It is undoubtedly certain, that ὑαλος, which is tranſlated *vitreous* or *glaſſy*, means any ſmooth poliſhed body capable of reflecting rays of light. Originally it ſignified a watery body; and becauſe watery bodies have a luſtre, it was at length uſed for glaſs. See *Salmaſ. ad Solin.* p. 771. Heſychius, therefore, explains ὑαλοεις and ὑαλον by λαμπρον.

placing ſome opake ſubſtance behind it *. Empedocles alſo ſaid, that the ſun was a mirror, and that the light received by our earth was the reflection of the ethereal fire, which Euſebius compares to the reflection made by water †.

In

* More obſervations reſpecting the opinion of Philolaus may be found in the edition of Plutarch's work *De placiis philoſophorum* by Ed. Corſinus, Florentiæ 1750, 4to. p. 61, and p. 23. I ſhall here add how it is underſtood by Riccioli, in his *Almageſtum novum*, i. p. 93: Solem non eſſe omnino opacum, ſed tanquam cryſtallum denſiſſimum, ita diaphanum eſſe, ut in profunditatem corporis ſolaris viſus noſter ſe inſinuet, et radii ad nos propagentur, non ex ſola ſuperficie, ſed etiam ex centro, ſolis. The opinion of Empedocles is explained in *I. N. Frobeſii Specimen polyhiſtoris heliographici.* Helmſtadii 1755, 4to. p. 30.

† Profeſſor Heeren having given me his opinion on this paſſage of Stobæus, I ſhall here inſert it for the ſatisfaction of the learned reader. The critics, ſays he, will hardly be perſuaded that the words και το απ' αυτου πυρειδες κατα το εσοπτρειδες are correct, as they can be tranſlated different ways. With regard to the explanation of the matter, I build only on the plain meaning of the words. The author tells us, that Philolaus thought the ſun to be a mirror; but we muſt conclude that he ſpeaks of a mirror ſuch as were then in uſe: a ſmooth plate of metal, and not a globe. In this caſe the firſt explanation of a glaſs globe falls to the ground. This is confirmed by Euſebius, who calls it ιαλοειδης δισκος, though it is poſſible that the latter word may be a gloſs added by ſome grammarian, or by Euſebius himſelf. If we enter farther into the explanation, we muſt adopt the plain idea, that the rays of the ſun fall upon this plate, and are reflected to us. (διηθουνται - - - κατ' ανακλασιν). I am however of opinion, that ὑαλος here ought to be tranſlated *glaſs*, ιαλοειδης *glaſſy* or *vitreous*; for the intention of Philolaus

In the problems aſcribed to Alexander of Aphrodiſias, glaſs mirrors, covered on the back with tin, are clearly mentioned *; but this information does

laus evidently was to define the ſubſtance of the ſun's body. The reſult of the whole is, Philolaus conſidered the ſun as a plain plate of glaſs which reflected the rays or brightneſs of the ethereal fire. But that he was acquainted with a proper glaſs mirror does not thence follow with certainty.

* As all the Greek editions of theſe *Problemata* are ſcarce, I ſhall here give the whole problem in the original. Διατι τα υελινα κατοπτρα λαμπουσιν αγαν; Οτι ενδοθεν αυτα χρωσι κασσιτερω. πεφυκε δ'αυτου ἡ φυσις διαυγης. και τη ἑλιῳ αναμιγνυμενη, λαμπραυουσα, πλειον διαυγαζεται και τας ιδιας ακτινας δια των πορων της ἑλου περιπεμπουσα, διπλασιαζει το επιπολης και εκτος του σωματος της ἑλου· και ουτως γινεται σφοδρα λαμπουσα. This problem may be found alſo in the very ſcarce edition of Ariſtotle, by Aldus, Venice 1495; in the edition of Sylburg, printed at Mechlin, p. 292; and in the Paris edition of the *Problemata*, by Conrade Neobarius, 1541, 12mo: Αλεξανδρου Αφροδισιεως Ιατρικα απορηματα και φυσικα προβληματα. In all theſe editions there is an addition, which however does not ſeem to belong to the problem; and which, as Sylburg ſays, is wanting in the oldeſt manuſcripts. Theodore Gaza muſt not have found this problem in his manuſcript, as it is not in his tranſlation printed along with the problems of Ariſtotle, at Paris, in quarto, without any date, with a preface by Martial Campius Carhoſſinus, though it contains the next problem: Quam ob cauſam in ſpeculis atque aquis dilucidis noſtram ſpeciem conſpicere valeamus. But it occurs, No. 132, in the edition of Politian, printed at Paris, in quarto, *(Proſtant in ædibus Nicolai Beraldi)*. It is inſerted alſo in the Latin edition of *Various Problems*: Amſtelod. apud Joan. Wæſbergios, 1685, 12mo. p. 219. In all theſe the addition is wanting; but it is inſerted in the following edition: *Alex. Aphrod. Problemata—Græce et Latine; Joannis Dauioni ſtudio illuſtrata,*

does not lead us one ſtep farther in the hiſtory of the art; as it is proved that the above Alexander, who lived in the beginning of the third century, could not have written that work. The author, who muſt have been a phyſician, maintains the immortality of the ſoul, which Alexander of Aphrodiſias, with Ariſtotle, denies. Some, therefore, have aſcribed theſe problems to Alexander Trallianus, who practiſed phyſic in the middle of the ſixth century; but this is only a conjecture which no one has as yet rendered probable, eſpecially as there have been many phyſicians of the name of Alexander. The problem to which I allude is not to be found in every manuſcript and edition; ſo that it is doubtful whether it may not be the production of a later author than that of the reſt of the book, particularly as it is certain

illuſtrata, Pariſiis 1541, 12mo. The tranſlation in this work I ſhall here tranſcribe:—Quare vitrea ſpecula ſplendeant plurimum? Quoniam ſtanni natura, quo intus illinuntur, cum ſit pellucida, vitro ex ſe perſpicuo commiſta, magis reſplendet, et radios ſuos per vitri exiguos meatus tranſmittens, ac externam illius corporis faciem duplicans, reddit magnopere lucidam. Qualitatum porro aliæ quidem vires ſuas in profundum nequaquam tranſmittunt; ut album, nigrum, fulvum et hujuſmodi; aliæ penitus transfundunt per tranſmutationem, ut frigus, calor, ſiccitas, humor, quæ propterea, ad diſcrimen et comparationem ſupra dictarum, effectrices qualitates a philoſophis et medicis appellantur.--A good account of the different editions of this book may be found in the edition of Ariſtotle printed at Deux-Ponts under the inſpection of Profeſſor Buhle, vol. i. p. 289.

that

that many who had it in their poſſeſſion added problems of various kinds according to their pleaſure. However this may be, it is evident that the author of this problem was acquainted with mirrors covered at the back; and the expreſſion which he uſes does not merely imply that a leaf of tin was placed behind the glaſs plate, but that the tin, in a liquid ſtate, was rubbed over it. The old French tranſlator thinks that the author ſpeaks of windows; but that opinion is undoubtedly falſe *.

Of as little importance as the above paſſage of Alexander, is another of Iſidore, often quoted in ſupport of the antiquity of glaſs mirrors. On the firſt view it appears to be a teſtimony of great weight; but when cloſely examined it becomes reduced to very little. "Nothing," ſays he, "is "ſo fit for mirrors as glaſs †." Abat and others, who have conſidered theſe words as deciſive, make leſs heſitation to aſcribe to the ſixth century, in

* Pourquoy reluient les feneſtres de verre ſi fort? Pourtant que la nature de l'eſtain, duquel elles ſont baſties par dedans, fort clere, meſlée avec le verre cler auſſi de lui meſme reluyſt d'avantage; et le quel eſtain outrepaſſant ſes raïons par les petits pores du verre, et augmentant doublement la face exterieure du dit verre, la rend grandement clere. *Les problemes d'Alexandre Aphrod.—traduit de Grec en François*—par M. Herret. A Paris 1555, 8vo. p. 50. n. 131.

† Origin. lib. xvi. 15. p. 394.

which

which Iſidore lived, a knowledge of mirrors covered on the back with tin and quickſilver, as the ſame writer, in another place, obſerves, that quickſilver can be kept in no veſſel but one of glaſs *. It is very true that a glaſs filled with that ſemimetal will form a very good mirror; but I am of opinion that this may have been long known before people thought of making an amalgam of tin and quickſilver in order to cover the backs of mirrors. The firſt paſſage, which is properly the one of any conſequence, loſes its force when one ſees that it is taken from Pliny and copied incorrectly. The latter ſays, that one can give to glaſs every kind of ſhape and colour, and that no ſubſtance is more ductile, or fitter to be moulded into any form †. Iſidore, as is uſual, ſays the ſame thing, and in the ſame words, except, that inſtead of *ſequacior* he ſubſtitutes *ſpeculis aptior*; ſo that the mention of a mirror is altogether unexpected, and ſo little ſuited to what goes before and what follows, that one muſt believe that this alteration, occaſioned perhaps by the ſimilitude of the words, or by an abbreviation, was not made by Iſidore

* Servatur autem melius in vitreis vaſis; nam cæteras materias perforat. Orig. xvi. 18, p. 396.

† Fit et album et murrhinum, aut hyacinthos ſapphiroſque imitatum, et omnibus aliis coloribus. Nec eſt alia nunc materia ſequacior, aut etiam picturæ accommodatior. Maximus tamen honos in candido tranſlucentibus, quamproxima cryſtalli ſimilitudine. *Lib.* xxxvi. cap. 26. p. 759.

but

but by ſome tranſcriber *. But even if we believe that Iſidore himſelf ſpoke of glaſs being uſed at that period for mirrors, we are not able to comprehend, from what he ſays, how glaſs mirrors were made in the ſixth century.

I have met with no information reſpecting this ſubject in the whole period between the age of Iſidore and the eleventh century. About the year 1100, at leaſt as is ſuppoſed not without probability, Alhazen the Arabian wrote his well-known treatiſe on Optics †, in which I conjectured that I ſhould find mention made of glaſs mirrors; but I ſearched that work in vain, though I muſt confeſs I did not read it through entirely. Where he begins his catoptrical leſſons, he, however, often ſpeaks of iron mirrors, by which we may underſtand mirrors of the beſt ſteel. In explaining a certain phenomenon, he ſays, that the cauſe of it cannot be in the darkneſs of the iron mirror, becauſe, if a mirror of ſilver be uſed, the ſáme

* This reading in Iſidore, however, muſt be old, for it is quoted by *Vincentius Bellovacenſis*, lib. vi. cap. 77, p. 415. He quotes alſo the words of Pliny, lib. vii. cap. 77, p. 474, but with a little variation as follows: Nec eſt materia ſequacior vel picturæ ſcilicet accommodatior.

† Opticus theſaurus Alhazeni, Arabis,——item Vitellonis Libri x. Omnes inſtaurati a Frederico Riſnero. Baſil. æ 1572. fol.

effects will be produced *. Would he not on this occaſion have introduced glaſs mirrors, had he been as well acquainted with them as with thoſe already mentioned? At firſt, he never ſpeaks of mirrors without adding of iron, of ſilver; but he mentions them afterwards without any epithet of the kind.

All theſe mirrors I find alſo in the Optics of Vitello †, who wrote in the middle of the thirteenth century, in Italy, a country which was at that time almoſt the only one where the arts flouriſhed ‡. That author has, indeed, borrowed a great deal from Alhazen, though there are many things of his own, and he gives an account of ſome experiments on the refracting power of glaſs; but he never, as far as I have obſerved, mentions glaſs mirrors. Whether Jordanus Nemorarius, or Nemoratius, who alſo wrote, in the thirteenth century, a book *De ſpeculorum natura*, makes mention of them, I do not know, becauſe I have never had an opportunity of ſeeing that work. I am of opinion it was never printed.

* Page 102, 103, 106. Speculum ferreum.—Sed dicet aliquis, cauſſam hujus rei eſſe nigredinem ſpeculi ferrei, - - - verum quod hoc non ſit in cauſſa, palam ex eo eſt, quod, loco ſpeculi ferrei, argenteo poſito, eadem accidit probatio.

† Page 191, 195, 196, 197. Speculum e ferro mundo.

‡ Bayle, Diction. Hiſtor. vol. iv. p. 462.

It

It is in the thirteenth century however that I find the firſt undoubted mention of glaſs mirrors covered at the back with tin or lead. Johannes Peckham, or Peccam, an Engliſh Franciſcan monk, who taught at Oxford, Paris, and Rome, and who died in 1292, wrote about the year 1279 a treatiſe of optics, which was once printed, with the title of *Johannis Piſani Perſpectiva communis* *. In this work, beſides mirrors made of iron, ſteel, and poliſhed marble, the author ſpeaks often, not only of glaſs mirrors, but ſays alſo that they were covered on the back with lead, and that no image was reflected when the lead was ſcraped off †. Vincentius

* Fabricius, in *Biblioth. medii ævi*, vol. iv. p. 331, ſays it was printed at Venice. Wolf, in *Unterrichten von mathematiſchen ſchriften*, quotes an edition printed at Cologne in 1624, eleven ſheets quarto. By the friendſhip of profeſſor Reuſs, I have now before me the following ſcarce edition: *Perſpectiva Joannis Piſani Anglici, viri religioſi, vulgo communis appellata. -- In gymnaſio Lipzenſi emendata atque in figuris quam diligentiſſime rectificata.* Thirty-eight leaves, ſmall folio, with monkiſh writing, and a broad margin, on which the coarſe figures are printed. At the end ſtands: Explicit Perſpectiva Piſani communis dicta, in felici gymnaſio Lipſenſi emendata reviſaque. Impreſſa arte et ſollertia Baccalarii Martini Herbipolenſis. an. dom. 1504. Reſpecting this edition, and the name *Piſanus*, which ſeems to have been a bye-name given by ſome one to Peckham, compare *Einleitung zur mathematiſchen bücherkenntniſs*, part ix. p. 280 and 284.

† Si res in ſpeculo oſtenduntur per radios reflexos, ut jam patet igitur perſpicuitas, per quam ſpecies in profundum ingreditur ſpeculi, impeditur, non expedit viſionem, quoniam reflexio eſt a denſo

tius Bellovacenſis * ſpeaks in a manner ſtill clearer, for he tells us that lead was poured over the glaſs plate while hot. To the ſame century alſo belongs the teſtimony of Raimundus Lullius †, Roger Bacon ‡, Antonio di Padua ||, and Nice-

denſo per primum hujus, quia denſum eſt, propter quod ſpecula vitrea ſunt plumbo ſubducta. Quod ſi, ut quidam fabulantur, dyaphoneitas eſſet eſſentialis ſpeculo, non fierent ſpecula de ferro et calibe, et a dyaphoneitate remotiſſimis. Nec etiam de marmore polito, cujus contrarium tamen videmus. In ferro autem et hujuſmodi, propter intenſionem nigredinis, non eſt efficax ſpeculatio. In quibuſdam tamen lapidibus debilis coloris multo clarior eſt ſpeculatio quam in vitris. *Propoſ.* 7.

In ſpeculis vitreis plumbo abraſo nihil apparere. *Propoſ.* 4.

* Metalla videmus eſſe ſpecula, quando polita ſunt et terſa, ut ferrum, argentum et talia. Idem quoque videmus de quibuſdam politis lapidibus - - - Argentum bene politum inter omnia metalla melius eſt ſpeculum, quia in colore magis accedit ad diaphanum. - - - At inter omnia melius eſt ſpeculum ex vitro et plumbo, quia vitrum propter tranſparentiam melius recipit radios, plumbum non habet humidum ſolubile ab ipſo, unde quando ſuperfunditur plumbum vitro calido - - - efficitur in altera parte terminatum valde radioſum. *Specul. natur.* ii. 78. p. 129.

† In ſpeculo vitrum exiſtit inter plumbum et aerem et figuram ſive colorem quæ ei præſentatur. Ars magna, cap. lxvii. p. 517, in *Lullii Opera quæ ad inventam ab ipſo artem pertinent.* Argentorati 1607, 8vo.

‡ Imago major fit per reflexionem a ſpeculo, quia ſpeculum denſum eſt, et habet plumbum ab altera ſui parte, quod impedit ſpeciei, et ideo ſpeculum habet unde recipiat imaginem et reddat. *Opus majus, edidit S. Jebb.* Londini 1733, fol. p. 346.

|| Speculum nihil aliud eſt quam ſubtiliſſimum vitrum. *Dominica V poſt Paſcha*, p. 210. In *Franciſci Aſſiſiatis et Antonii Paduani Opera.* Lugduni 1653, fol.

phorus Gregoras *, who died after the year 1360 †.

That this invention cannot be much older, we have reaſon to conclude, becauſe glaſs mirrors were extremely ſcarce in France even in the fourteenth century, while mirrors of metal were in common uſe; and we are told that the mirror of Anne de Bretagne, conſort of Louis XII, was of the latter kind ‡. Metal mirrors alſo were made and employed in Perſia and the Eaſt, where indeed an-

* Εισι γαρ και εξ υελων κατοπτρα, και εκ σιδηρου, και εξ αλλης ὑλης. Sunt enim ex vitro ſpecula et ex chalybe et alia materia. *Nicephori Scholia in Syneſium*, at the end of Syneſii Opera, interprete Dionyſio Petavio. Lutetiæ 1612, fol. p. 419.

† In the collection of antiquities at St. Denis, an ancient mirror was ſhewn, which was ſaid to have belonged to Virgil. It was oval, and, before Mabillon let it fall, was fourteen inches in length, and twelve in breadth, and weighed thirty pounds. It is tranſparent, and of a browniſh-yellow colour. According to experiments made on purpoſe, it was found to conſiſt of artificial glaſs, mixed with a conſiderable portion of lead; and as it had been preſerved in the above collection, from the earlieſt periods, the practice of adding lead to glaſs muſt be very old. But whether this mirror was covered at the back, and how it was covered, though theſe are the moſt important points, I find no where mentioned. In the collection of the Grand Duke of Tuſcany there is a piece of the ſame kind, ſaid alſo to have been the mirror of Virgil. See *Le Veil, Kunſt auf glas zu malen*, Nurnberg 1779, 4to. p. 23, and *Hiſt. de l'Acad. des ſciences à Paris, annee* 1787, p. 412.

‡ This is related by Villaret in his continuation of *Hiſtoire de France*, begun by Velly. Paris 1763, tome xi. p. 142.

cient

cient uſages continued longeſt, and glaſs mirrors were not known there till the commencement of the European trade with theſe remote regions. The former are ſtill preferred in thoſe countries, becauſe they are not ſo liable to break, and can be preſerved better in a dry hot climate than the amalgam of the latter *. .

Reſpecting the progreſs of this art, I know nothing more than what follows: At firſt, melted lead, or perhaps tin, was poured over the glaſs plate while yet hot as it came from the furnace. This proceſs agrees with that which, ſince very early periods, has been employed in or around Nuremberg for making convex mirrors by blowing with the pipe into the glaſs-bubble ſtill hot a metallic mixture, with a little reſin or ſalt of tartar, which prevents calcination, and aſſiſts the fuſion. When the bubble is covered all over in the inſide, and after it has cooled, it is cut into ſmall round mirrors. This art is an old German invention, for it is deſcribed by Porta † and Garzoni ‡, who both lived in the beginning of the ſixteenth century, and who both expreſsly ſay, that it was then common in Germany. Curious foreigners

* Voyage de Chardin. Rouen 1723, 8vo. iv. p. 252.

† Magia natural. xvii. 22. p. 618. *Zahn, Oculus artificialis.* Herbipoli 1686, fol. iii. p. 171.

‡ Piazza univerſale, diſc. 145, p. 383.

often attempted to learn it, and imagined that the Germans kept it a ſecret. Mr. Boyle * made various experiments in order to diſcover the proceſs; and the ſecretary of the Royal Society endeavoured, by means of the ambaſſador from Charles II, who, perhaps about 1670, reſided at Franckfort, to obtain a knowledge of it; but did not ſucceed, as we are told by Leibnitz †. It was called the art of preparing mirrors without foil; and it was highly eſteemed, becauſe it was ſuppoſed that it might be uſeful to thoſe fond of catoptrics, by enabling them to form convex and concave mirrors themſelves. This account of Leibnitz ſeems to have led Mr. Von Murr ‡ into a ſmall error, and induced him to believe that the art of making convex mirrors without foil was firſt found out at Nuremberg in 1670. I introduce this remark becauſe

* De utilitate philoſophiæ natur. experimentalis. Lindaviæ 1692, 4to. exercit. viii. § 46, 48. p. 536. The original was printed at London in 1664.

† Miſcellanea Berolinenſia, tom. i. p. 263: De arte Noribergenſi ſpecula vitrea conficiendi ſine foliis. I find this account inſerted alſo in *Hiſtoriſch-diplomatiſches magazin für das vaterland*, Nurnberg 1781, 8vo. i. p. 115; but nothing farther is ſaid reſpecting the art than that it was daily uſed in the glaſs-houſes. Had I an opportunity, I ſhould make experiments of every kind in order to diſcover a method of forming plane mirrors alſo in the like manner.

‡ Beſchreibung der merkwürdigkeiten in Nürnberg, 1778, 8vo. p. 737.

I flatter

I flatter myſelf he will not be diſpleaſed that I make the above ſervice, rendered by his native city, to be a century and a half older. Theſe ſmall convex mirrors, which reflect a diminiſhed, but a clearer image than our uſual mirrors, are perhaps made ſtill, though they are not now carried round ſo frequently for ſale in Germany as they were thirty years ago, at which time, if I remember right, they were called *(ochſen-augen)* ox-eyes. They were ſet in a round painted board, and had a very broad border or margin. One of them, in my poſſeſſion, is two inches and a half in diameter. It is probable that the low price of plane mirrors, when glaſs-houſes began to be more numerous, occaſioned theſe convex ones to be little ſought after. The mixture employed in making them, was, according to Porta, antimony, lead and colophonium; but according to Garzoni it was *una miſtura di piombo, ſtagno, marcheſita d'argento, e tartaro*, which in the German edition is tranſlated very badly, "lead, tin, flint, ſilver and tartar." The following obſervation perhaps is not altogether uſeleſs: Colophonium, which is employed on many other occaſions for ſoldering, was formerly called mirror-reſin, and was ſold under that name even in the beginning of the preſent century. Friſch aſſigns no reaſon for this appellation, and Jacobſon gives a wrong one, viz. Its having a bright ſhining ſurface when broken. The true reaſon was the above-mentioned uſe; and as that is now very little

known, it is called from that to which it is principally applied, violin-reſin.

It appears, that, inſtead of pouring melted metal over plates of glaſs, artiſts for ſome time applied to them the before-mentioned amalgam of tin, or covered them in ſome other manner, perhaps in the ſame as Boyle covered concave glaſſes in the inſide *. Porta however ſaw almoſt the ſame proceſs employed at Murano as that which is ſtill followed at preſent. The tin hammered to thin leaves was ſpread out very ſmoothly; the quickſilver was poured over it, and rubbed into it, either with the hand or a hare's foot; and when the tin was ſaturated it was covered with paper. The glaſs, wiped exceedingly clean, was then laid above it; and while the workman preſſed it down with his left hand, he drew out very carefully with his right the paper that lay between the tin and the glaſs, over which weights were afterwards placed †. This much at any rate is certain, that the method of covering with tin foil was known at Murano ſo early as the ſixteenth century ‡, and it is therefore much

* Page 536. The receipt may be ſeen tranſlated in that well-known work, *Croker's Mahler*. Jena 1778, 8vo. p. 421.

† Magia natural. xvii. 22. p. 619. The whole proceſs is deſcribed by Zahn in a manner ſtill clearer. See his work before quoted. Hartſoeker alſo gives directions for covering concave mirrors in the like manner, in *Acta Berolin.* i. p. 262.

‡ Wecker, in his book *De ſecretis*, lib. x. p. 572, ſeems to ſay, that

much older than Joh. Maur. Hoffmann thinks *. To conclude, whether this ingenious invention belongs to the Venetians, as ſeveral later, and particularly Italian, writers aſſert, I can neither prove nor contradict; but it is well known that till about the end of the ſeventeenth century their mirrors were ſold all over Europe and in both the Indies. After that period the glaſs-houſes in other countries were improved, and new ones eſtabliſhed; and the diſcovery made in France, that glaſs, like metal, could be caſt into much larger plates than had been before prepared by blowing and rolling, was in more than one reſpect prejudicial to the ſale of thoſe made at Venice.

that one muſt lay the ſaturated tin leaf ſo carefully on the glaſs plate, that no air can ſettle between them. According to Garzoni, the tin leaf is ſpread out on a ſmooth ſtone table, and after it has been rubbed over with quickſilver, the glaſs is placed above it.

* Amalgama ex parte una Jovis et partibus tribus Mercurii vivi ad poſticam ſpeculorum ſuperficiem obducendam uſuale habetur, quamvis Veneti hodie ex tempore tale conficiant impoſitæ futuræ ſpeculi ſuperficiei interiori laminæ Joviali tenuiori Mercurium vivum ſuperaffundendo, illius meatus in momento ſubintrante, atque amalgama relinquente, reſiduo fluido mox detergendo. *Acta laboratorii chemici Altdorfini.* Norimb. 1719, 4to. p. 245.—It appears to me, that the proceſs is here deſcribed as if the glaſs plate were firſt covered with tin leaf and the quickſilver afterwards poured over it. It is deſcribed in the ſame manner by Macquer in *Allgem. begriffe der chemie*, edition of Porner, ii. p. 635. Of that uſed at preſent I have given a ſhort account in *Anleitung zur technologie*, p. 348.

So early as the year 1634, attempts were made in France to eſtabliſh glaſs-houſes for manufacturing mirrors, and Euſtache Grandmont obtained a patent for this purpoſe; but his undertaking was not attended with ſucceſs. As Colbert exerted himſelf very much to promote manufactures of every kind, Nicholas de Noyer propoſed to make mirrors according to the Venetian method. This plan was adopted by Charles Riviere, ſieur du Freni, valet-de-chambre to the king; and having procured the royal permiſſion, he ſold it afterwards for a large ſum to De Noyer, who, in 1665, received a confirmation of the patent, and an advance of 12,000 livres for four years, on condition of his procuring workmen from Venice, who, after ſerving eight years in the kingdom, were to be naturalized. De Noyer was joined by ſeveral more, who entered into partnerſhip with him, and particularly by one Poquelin, who had hitherto carried on the greateſt trade in Venetian mirrors, and who engaged workmen from Murano. The glaſs-houſes were erected at the village of Tourlaville, near Cherbourg, in Lower Normandy. After the death of Colbert, who was ſucceeded by Louvois, the charter of the company was in 1684 renewed for thirty years longer, and at that period Pierre de Bagneux was at the head of it.

Scarcely had five years of this period elapſed, when, in 1688, Abraham Thevart made a propo-

ſal to the court for caſting glaſs mirrors of a much larger ſize than any ever before made. This plan, after an accurate inveſtigation, was approved; and in the ſame year he received the royal permiſſion to uſe his invention for thirty years, but it was not regiſtered till 1693 or 1694. The firſt plates were caſt at Paris, and aſtoniſhed every artiſt who ſaw them. They were eighty-four inches in height, and fifty in breadth. In order to leſſen the exceſſive expence, the glaſs-houſes were erected at St. Gobin, in Picardy; and to prevent all diſpute with the old privileged company, Thevart was expreſsly bound to make plates at leaſt ſixty inches in length, and forty in breadth, whereas the largeſt of thoſe made before had never exceeded forty-five or fifty inches in length. On the other hand, the old company were allowed to make plates of a ſmaller ſize, and were prohibited from employing any of the inſtruments or apparatus invented by Thevart. Theſe however had not been ſo accurately defined as to remove all cauſe of litigation between the companies, and for that reaſon permiſſion was at length granted in 1695, for both to be united into one, under the inſpection of François Plaſtrier, to whom the king in 1699 ſold the palace of St. Gobin. After this they declined ſo rapidly, that in 1701 they were not able to pay their debts, and they were obliged to abandon ſeveral of the furnaces. To add to their misfortune, ſome of the workmen whom they had diſcharged, retired to

other

other countries, which were already jealous of the French invention, and wiſhed to turn it to their advantage. The French writers aſſert, that their attempts never ſucceeded, and that moſt of the workmen returned again to France, when a new company was formed in 1702, under the management of Antoine d'Agincourt, who by prudent œconomy improved the eſtabliſhment, ſo as to render the profit very conſiderable. At preſent, mirrors are caſt as well as blown, both at St. Gobin and at Cherbourg; and in 1758 the price of them was greatly reduced, in order probably to weaken the competition of the foreign glaſs-houſes, among which there are many not inferior to the French.

This ſhort hiſtory of the glaſs manufactories in France is collected from Savary * and Expilly †. A more particular account perhaps may be expected of the inventor, of his firſt experiments, and of their ſucceſs; but notwithſtanding a ſtrict ſearch, I have not been able to find any farther information on the ſubject. We are told only that his name was ſieur Abraham Thevart, though the hiſtorians who record that circumſtance have filled their pages with unintereſting anecdotes, and even with the vices of many of the courtiers of the ſame period.

* Tome iii. p. 87. art. *Glace.* A tranſlation of it has been inſerted in *Gemeinnützige natur- und kunſt-magazin*, i. p. 293.

† Dictionnaire géographique de la France. Amſterd. 1762, 1770, fol. v. p. 415. The article however ſeems to be taken from Savary. Some additions may be found p. 672.

The principal benefit which has properly arisen to the art from this invention, is, that much larger mirrors can be obtained than formerly; for when attempts were made to blow very large plates, they were always too thin. Casting, however, besides great expence in apparatus *, requires so many expert workmen, and so tedious and severe labour, and is accompanied with so much danger, that it is only seldom that plates of an extraordinary size succeed, and the greater part of them must be cut into smaller plates which might have been blown. Those cast are never so even and smooth as those that have been blown; they require therefore a great deal of polishing, and on that account must be very thick. The monstrous mass requisite for a mirror of the largest size, stands ready melted in a very frail red-hot earthen pot, which is taken from the oven, and must be lifted upon an iron plate, strongly heated, that the mass may be poured upon the table, which must be speedily conveyed to the cooling-oven. If it be found free from faults, it is ground, polished, and silvered; but the last part of the process is generally

* A furnace for casting large glass plates, before it is fit to be set at work, costs, it is said, 3,500l. It seldom lasts above three years, and even in that time it must be repaired every six months. It takes six months to rebuild it, and three months to repair it. The melting-pots are as big as large hogsheads, and contain above 200 weight of metal. If one of them burst in the furnace, the loss of the matter and time amounts to 250l. TRANS.

done

done at the place where a purchaſer can be found for ſo expenſive an article, in order that leſs loſs may be ſuſtained in caſe it ſhould happen to break by the way.

Theſe great difficulties, which have excited the aſtoniſhment of every one who has ſeen the proceſs, and that of finding ſale for ſo expenſive and magnificent wares, have obliged artiſts to return to the old method of blowing; and many have been ſo fortunate in improving this branch of manufacture, that plates are formed now by blowing, ſixty-four Flemiſh inches in height, and twenty-three in breadth, which it was impoſſible to make before but by caſting.

The maſs of matter neceſſary for this purpoſe, weighing more than a hundred pounds, is by the workman blown into the ſhape of a large bag; it is then reduced to the form of a cylinder, and being cut up, is, by ſtretching, rolling it with a ſmooth iron, and other means not yet known but to thoſe employed in the art, transformed into an even plate.

GLASS-

GLASS-CUTTING. ETCHING ON GLASS.

I DO not here mean to enter into the hiſtory of engraving on ſtone, as that ſubject has been already ſufficiently illuſtrated by ſeveral men of learning well acquainted with antiquities. I ſhall only obſerve, that the ancient Greek artiſts formed upon glaſs, both raiſed and engraved figures; as may be ſeen by articles ſtill preſerved in collections, though it is probable that many pieces of glaſs may have been moulded like paſte; for that art alſo is of very great antiquity *. It appears likewiſe that they cut upon plates of glaſs and hollow glaſs veſſels all kinds of figures and ornaments, in the ſame manner as names, coats of arms, flowers, landſcapes, &c. are cut upon drinking-glaſſes at preſent †. If we can believe that learned engraver in ſtone, the celebrated Natter, the ancients employed the ſame kind of inſtruments for this purpoſe as thoſe uſed by the

* Traité des pierres gravées, par Mariette. Paris 1750, fol. i. p. 92, 210.

† If I am not miſtaken, the two ancient glaſſes found at Niſmes, and deſcribed in Caylus' *Recueil d'antiquités*, ii. p. 365, were both of this ſort.

moderns.

moderns *. They undoubtedly had in like manner a wheel which moved round in a horizontal direction above the work-table, or that machine which by writers is called a lapidary's wheel †.

If this conjecture be true, what Pliny ſays ‡ reſpecting the various ways of preparing glaſs is perfectly intelligible. It is turned, ſays he, by the wheel, and engraven like ſilver. In my opinion we are to underſtand by the firſt part of this ſentence, that the glaſs hollowed out like ſtone was afterwards cut by the wheel, though it is poſſible that drinking-cups or veſſels may have been formed from the glaſs metal by means of the wheel alſo ||. In the latter part of the ſentence, we muſt not imagine that Pliny alludes to gravers like thoſe uſed by ſilver-ſmiths, for the compariſon will not apply to inſtruments, or to the manner of work-

* Traité de la méthode antique de graver en pierres fines, comparé avec le methode moderne ; par Laur. Natter. Londres 1754. fol.

† I ſay by writers, becauſe I never heard that word uſed by workmen ; and the ſame is the caſe with the word *fritte*, which, though common in books, is in moſt glaſs-houſes not known.

‡ Aliud flatu figuratur, aliud torno teritur, aliud argenti modo cælatur. *Lib.* xxxvi. 26. p. 758.

|| Of this kind were the *calices audaces* of Martial, xiv. 94, and thoſe cups which often broke when the artiſt wiſhed to give them the finiſhing touch.

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ing, which in ſilver and glaſs muſt be totally different; but to the figures delineated on the former, which were only cut out on the ſurface in a ſhallow manner and ſuch figures were formed on glaſs by the ancient artiſts, as they are by our glaſs-cutters, by means of a wheel.

Many, however, affirm, that the art of glaſs-cutting, together with the neceſſary inſtruments, was firſt invented in the beginning of the laſt century. The inventor is ſaid to have been Caſpar Lehmann, who originally was a cutter of ſteel and iron; and who made an attempt, which ſucceeded, of cutting cryſtal, and afterwards glaſs, in the like manner. He was in the ſervice of the emperor Rodolphus II. who, in the year 1609, beſides preſents, conferred on him the title of lapidary and glaſs-cutter to the court, and gave him a patent by which every one except himſelf was forbidden to exerciſe this new art. He worked at Prague, where he had an aſſiſtant named Zacharias Belzer; but George Schwanhard the elder, one of his ſcholars, carried on the ſame buſineſs to a far greater extent. The latter, who was a ſon of Hans Schwanhard, a joiner at Rothenburg, was born in 1601; and in 1618 went to Prague to learn the art of glaſs-cutting from Lehmann. By his good behaviour he ſo much gained the eſteem of his maſter, who died a bachelor in 1622, that he was left his heir; and obtained from the

emperor

emperor Rodolphus a continuation of Lehmann's patent. Schwanhard, however, removed to Nuremberg, where he worked for many of the principal nobility; and by theſe means procured to that city the honour of being accounted the birth-place of this new art. In the year 1652 he worked at Prague and Ratiſbon by command of the emperor Ferdinand III, and died in 1667, leaving behind him two ſons, who both followed the occupation of the father. The elder, who had the ſame chriſtian name as the father, died ſo early as 1676; but the other, Henry, ſurvived him ſeveral years. After that period Nuremberg produced in this art more expert maſters, who, by improving the tools, and deviſing cheaper methods of employing them, brought it to a much higher degree of perfection *.

That the art is of ſo modern date, ſeems to be confirmed by Zahn, who ſpeaks of it as of a new employment carried on, at that time, particularly

* This account may be found in *Sandrart's Teutſche akademie*, vol. i. part 2, p. 345, where the expreſs words of the Imperial patent are given; but in the new edition by Dr. Volkman very little of it has been retained. Beſides many other faults of this edition, much valuable information reſpecting the German artiſts has been omitted. Thoſe who may be deſirous of writing on the preſent ſubject muſt have the firſt edition. Compare alſo *Doppelmayer, Nachricht von Nürnberg. künſtlern*, p. 231, 232, 237.

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at Nuremberg. He deſcribes the work-table, as well as the other inſtruments; and gives a figure of the whole, which he appears to have conſidered as the firſt *. It may be ſeen, however, from what I have already quoted, that this invention does not belong entirely to the moderns; and, to deny that the ancients were altogether unacquainted with it would be doing them an injuſtice. It was forgotten and again revived; and this is the opinion of Caylus †.

I muſt here remark, that, before this invention, there were artiſts who, with a diamond, cut or engraved figures on glaſs which were every where

* Non ità pridem innotuit pulcerrimum artificium quaſcunque imagines etiam contrafacturas, quaſcunque figuras, notas et ſcripturas curioſiſſime in vitrâ incidendi; præcipue autem vitra potiora illò ſolent ornâri. Norimbergæ modo fuit artifex, qui imagines contrafacturas artificioſiſſime iiſdem incidendo exhibuit. Vidi tale vitrum potorium ab eo elaboratum non adeo magnum, cujuſdam principis Germaniæ effigiem nitidiſſime ac perfectiſſime præſentans, pretio quadraginta imperialium ab eodem coemptum; multo autem majoris adhuc pretii alia ab eodem artifice confecta audivi arte ſingulariſſima, qua incidendo ac interendo ita effigiat imagines, ut non intritæ ac impreſſæ compareant, velut in iis vitris quæ communiter diſtrahuntur ac venduntur, ſed emineant et extent elatiores, perfectiſſimeque ſint expolitæ. *Oculus artificial.* iii. p. 79. In the laſt part of this quotation Zahn alludes to images which were affixed to glaſs-ware intended for common uſe.

† Recueil d'antiquités, ii. p. 363.

admired. Without entering, however, into the hiſtory of diamonds, which would require more materials than I have yet been able to collect, I will venture to aſſert that the ancient artiſts employed diamond duſt for poliſhing or cutting other kinds of ſtones. Pliny * ſpeaks of this in ſo clear a manner that it cannot be doubted. The ſame thing has been repeated by Solinus †, Iſidore ‡, and Albertus Magnus §, in a manner equally clear, and Mariette ‖ conſiders it as fully proved; but it does not appear that the ancients made any attempts to cut this precious ſtone with its own duſt: I mean to give it different faces and to render it brilliant. Whether they engraved on it in that manner I cannot pretend to decide, as the greateſt artiſts are not agreed on the ſubject. Mariette ¶ denies that they did; whereas Natter **

* Expetuntur a ſcalptoribus, ferroque includuntur, nullam non duritiam ex facili cavantes. *Lib.* xxxvii. 4. p. 773.

† Fragmenta ſcalptoribus in uſum inſigniendæ cujuſcunque modi gemmæ expetuntur. *Cap.* 52. p. 59.

‡ Adamantis fragmentis ſcalptores pro gemmis inſigniendis perforandiſque utuntur. *Origin.* xvi. 8.

§ Hic lapis penetrat ferrum et ceteras gemmas omnes, præter chalybem, in quo retinetur. *De miner.* lib. ii. 2.

‖ Mariette, Traité des pierres gravées, i. p. 90 and 156.

¶ Ibid. p. 156.

** In the preface, p. 15.

ſeems not to deny it altogether, and Klotz * confidently aſſerts it as a thing certain. But the laſt-mentioned author knew nothing more of this circumſtance than what he had read in the above-quoted writers.

The queſtion which properly belongs to my ſubject is, whether the Greeks and the Romans uſed diamond pencils for engraving on other ſtones. That many ancient artiſts aſſiſted their work with them, or gave it the finiſhing touches, ſeems, according to Natter †, to be ſhewn by various antique gems. But, even allowing this to have been the caſe (for, at any rate, I dare not contradict ſo eminent a connoiſſeur), I muſt confeſs that I have found no proofs that the ancients cut glaſs with a diamond. We are, however, acquainted with the means employed by the old glaziers to cut glaſs: they uſed for that purpoſe emery, ſharp-pointed inſtruments of the hardeſt

* Ueber den nutzen der geſchnittenen ſteine. Altenburg 1768. 8vo. p. 42. How little Klotz, who was ſo ready to remark and criticiſe the faults of others, was acquainted with the ſubſtances on which the ancients engraved, may be ſeen in p. 44, where he ſays, that the ancients engraved likewiſe on ambergris —Perhaps, alſo, on cheeſe! He had read in his French author the word *ambre*, but did not know the difference between *ambre gris* and *ambre jaune*.

† Page 10, 36. The ſame thing is aſſerted by H. Doll, in *H. Meuſels Muſeum für künſtler*. ſt. 13.

ſteel, and a red hot iron, by which they directed the rents according to their pleaſure *.

The firſt mention of a diamond being uſed for writing on glaſs occurs in the ſixteenth century. Francis I. of France, who was fond of the arts, ſciences, and new inventions †, wrote the following lines with his diamond ring upon a pane of glaſs, at the caſtle of Chambord, in order to let Anne de Piſſeleu, ducheſs of Eſtampes, know that he was jealous:

Souvent femme varie,
Mal habil qui s'y fie.

The hiſtorian recorded this not ſo much on account of the admonition, which is not new, as becauſe it was then thought very ingenious to write upon glaſs ‡. About the year 1562, feſtoons

* Le Veil, Die Kunſt auf glas zu malen. Nurnb. 1780, 4to. iii. p. 19.

† Daniel, Geſchichte von Frankr. viii. p. 570.

‡ Le Veil, iii. p. 19. Where he found this anecdote, however, I do not know. It is not mentioned by Mezeray, Caſtelnau, or Labourcur; nor does it occur in *Galanteries des rois de France, Bruxelle* 1694. 8vo. i. p. 145, which is all taken from Varillas. Bellay, in his Memoirs of the Ducheſs, ſays nothing of it. Bayle muſt alſo have been unacquainted with it, elſe he would have introduced it into his long article on the *Ducheſſe d'Eſtampes*. Perhaps it may be in Brantome's *Dames galantes*. The king's acquaintance with that lady began in 1526. See *Daniel's Geſchichte von Frankr.* viii. p. 328.

and

and other ornaments, cut with a diamond, were extremely common on Venetian glaſſes, which, at that period, were accounted the beſt *. George Schwanhard the elder was a great maſter in this art †; and, in more modern times, John Koſt, an artiſt of Augſburg, ornamented, in a very curious manner with a diamond pencil, ſome drinking-glaſſes which were purchaſed by the emperor Charles VI ‡.

I now come to the art of etching on glaſs, which properly was the ſubject of this article. As that acid which diſſolves ſiliceous earth, and alſo glaſs, was firſt diſcovered in the year 1771, by Scheele the chemiſt ||, in ſparry fluor, one might imagine that the art of engraving with it upon glaſs could not be older. It has indeed been made known by many as a new invention §; but it can

* Matthefius ſays, in his fifteenth ſermon, p. 902: "On the beautiful ſmooth Venetian glaſs people engrave with a diamond all kinds of ornaments and figures."

† Doppelmayr, p. 232.

‡ Von Stetten, Kunſtgeſchichte von Augſburg, i. p. 434.

|| Abhandlungen der Schwediſchen Akademie, xxxiii. p. 122. It deſerves to be remarked, that Henkel, in his *Kleinen ſchriften*, Dreſden 1744. 8vo. p. 594 and 599, conſidered ſparry fluor as a ſaline ſubſtance.

§ Monatſchrift der Akademie der Künſte zu Berlin. Berlin, 1788. 4to. *Schriften der Berliniſchen naturforſchenden Geſelſchaft.* ii. p. 319. *Halle, Fortgeſetzte magie.* Berlin 1788. 8vo. i. p. 516. The laſt author ſays that the invention came from England, where it was kept very ſecret; but the honour of the ſecond invention belongs to H. Klaproth.

be proved that it was diſcovered ſo early as the year 1670, by the before-mentioned artiſt Henry Schwanhard. We are told, that ſome aqua-regia having fallen by accident upon his ſpectacles, the glaſs was corroded by it; and that he thence learned to make a liquid by which he could etch writing and figures upon plates of glaſs *. How Schwanhard prepared this liquid I find no where mentioned; but, at preſent, we are acquainted with no other acid but that of ſparry fluor which will corrode every kind of glaſs †; and it is very probable that his preparation was the ſame as that known to ſome artiſts as a ſecret in 1721. The inventor, however, employed it to a purpoſe different from that for which it is uſed at preſent.

* Schwanhard, by the acuteneſs of his genius, proved what was before conſidered as impoſſible, and found out a corroſive ſo powerful that the hardeſt cryſtal glaſs, which had hitherto withſtood the force of the ſtrongeſt ſpirits, was obliged to yield to it, as well as metals and ſtones. By theſe means he delineated and etched on glaſs, figures of men, ſome naked and ſome dreſſed, and all kinds of animals, flowers and plants, in a manner perfectly natural; and brought them into the higheſt eſtimation. *Sandrart, Teutſche Akademie*, i. 2. p. 346. The ſame account, but nothing more, may be found in *Wagenſeilii Commentat. de civitate Norimbergenſi.* Altdorfi 1697. 4to. p. 154. Doppelmayr, p. 250, ſays: After 1670 he accidentally found out by the glaſs of his ſpectacles, upon which ſome aqua regia had fallen, becoming quite ſoft, the art of etching on glaſs.

† I ſay all glaſs, becauſe many kinds can be corroded by the marine and vitriolic acids. See *Baume, Experimental chemie*, iii. p. 302.

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At preſent the glaſs is covered with a varniſh, and thoſe figures which one intends to etch are traced out through it; but Schwanhard, when the figures were formed, covered them with varniſh, and then by his liquid corroded the glaſs around them; ſo that the figures, which remained ſmooth and clear, appeared, when the varniſh was removed, raiſed from a dim or dark ground. He, perhaps, adopted this method in order to render his invention different from the art known long before of cutting the figures on the glaſs as if engraven. Had he been able, however, to inveſtigate properly what accident preſented to him, he might have enriched the arts with a diſcovery which acquired great reputation to a chemiſt, a hundred years after.

I mentioned this old method of etching in relief to our ingenious Klindworth, who poſſeſſes great dexterity in ſuch arts, and requeſted him to try it. He drew a tree with oil varniſh and colours on a plate of glaſs; applied the acid to the plate in the uſual manner, and then removed the varniſh. By theſe means a bright, ſmooth figure was produced upon a dim ground, which had a much better effect than thoſe figures that are cut into the glaſs. I recommend this proceſs, becauſe I am of opinion that it may be brought to much greater perfection; and Mr. Renard, that celebrated artiſt of Straſburgh, whoſe thermometers

with glaſs ſcales, in which the degrees and numbers are etched, have met with univerſal approbation, was of the ſame opinion, when I mentioned the method to him while he reſided here, baniſhed from his home by the diſturbances in his native country.

It is probable that Schwanhard and his ſcholars kept the preparation of this liquid a ſecret, as the receipt for that purpoſe was not made known till the year 1725, though it is poſſible that one older may be found in ſome of thoſe books which treat on the arts. In the above-mentioned year, Dr. John George Weygand, from Goldingen in Courland, ſent to the editor of a periodical work * a receipt which had been written out for him by Dr. Matth. Pauli of Dreſden, then deceaſed, who had etched, in this manner on glaſs, arms, landſcapes, and figures of various kinds †.

We

* Breſlauer Sammlung zur natur- und medicin-geſchichte.

† 1725. January, p. 107. "Invention of a powerful acid by which figures of every kind, according to fancy, can be etched upon glaſs.—When *ſpiritus nitri per diſtillationem* has paſſed into the recipient, ply it with a ſtrong fire, and when well dephlegmated pour it, as it corrodes ordinary glaſs, into a Waldenburg flaſk; then throw into it a pulveriſed green Bohemian emerald, otherwiſe called *heſphorus* (which, when reduced to powder and heated, emits in the dark a green light), and place it in warm ſand for twenty-four hours. Take a piece of glaſs well cleaned and freed from all greaſe by means of a lye; put a border of

wax

We find by it that a ſtrong acid of nitre was uſed, which certainly diſengages the acid of ſparry fluor, though the vitriolic acid is commonly employed for that purpoſe *. That the Bohemian emerald or *heſphorus*, mentioned in the receipt, is green ſparry fluor, cannot be doubted, and will appear ſtill more certain from the hiſtory of this ſpecies of ſtone, as far as I am acquainted with it, which I ſhall here inſert.

In the works of the old mineralogiſts, ſparry fluor is either not mentioned, or is claſſed among their natural glaſſes and precious ſtones; and in thoſe of the firſt ſyſtematic writers it is ſo mingled with quartz, and calcareous and gypſeous ſpars, that it is impoſſible to diſcover it. The old German miners, however, diſtinguiſhed it ſo early as the ſixteenth century, and called it *fluſs*; becauſe

wax round it, about an inch in height, and cover it all equally over with the above acid. The longer you let it ſtand ſo much the better, and at the end of ſome time the glaſs will be corroded, and the figures, which have been traced out with ſulphur and varniſh, will appear as if raiſed above the plane of the glaſs." This receipt has been inſerted by H. Krunitz, in his *Œkonomiſche encyclopedie*, xi. p. 678.

* Klindworth covers the glaſs with the etching ground of the engravers; but in the *Annals of Chemiſtry* for 1790, ii. p. 141, a ſolution of iſinglaſs in water, or a turpentine oil varniſh, mixed with a little white lead, is recommended. Complete inſtructions for acquiring this art may be found there alſo.

they

they uſed it to accelerate the fuſion of ores that were difficult to be reduced to that ſtate. Agricola, who firſt remarked this, changed the German name into *fluor*, an appellation, which, like many others, formed by him from German words, ſuch, for example, as *quarzum* from *quarz*, *ſpatum* from *ſpat*, *wiſmuthum*, *zincum*, *cobaltum*, &c. became afterwards common *. If a paſſage of the ancients can be quoted that ſeems to allude to ſparry fluor, it is that of Theophraſtus, where he ſays, that there are certain ſtones which, when added to ſilver, copper, and iron ores, become fluid †. The firſt ſyſtematic writer who mentioned this kind of ſtone, as a particular genus, was Cronſtedt.

Beſides being known by its metallurgic uſe, ſparry fluor is known alſo by having the colours of ſome precious ſtones, ſo that it may be ſold, or, at leaſt, ſhewn as ſuch to thoſe who are not expert judges; becauſe the firſt time when heated in the dark it ſhines with a blueiſh green luſtre. It is poſſible that ſparry fluor may have been among the number of that great variety of ſtones

* Lapides ſunt gemmarum ſimiles, ſed minus duri, fluores, liceat mihi verbum e verbo exprimere, noſtri metallici appellant, nec, meo judicio, inepte; ſiquidem ignis calore, ut glacies ſolis, liqueſcunt et fluunt. Varii autem et jucundi colores eis inſidunt. *Bergmannus*, p. 466.

† De lapidibus, § 19.

which

which the ancients, with much aſtoniſhment, tell us ſhone in the dark; though it is certain that the principal part of them were only light-magnets, as they are called, or ſuch as retain, for a certain period, the light they have abſorbed in the day time *. The obſervation, however, that ſparry fluor emits light, after it is heated, ſeems to have been firſt made when artificial phoſphorus excited the enquiry of naturaliſts and chemiſts; and when they began to ſearch, in their own country, for ſtones which, in the property of emitting light, might have a reſemblance to the Bologna ſpar, made known about the year 1630. It is well known that the latter is prepared for that purpoſe by calcination. Stones of the like kind were ſought for; and among theſe ſparry fluor, which is not ſcarce in Germany.

In my opinion, the obſervation was made in the year 1676; for in that year Elſholz informed the members of the ſociety for inveſtigating nature, that he was acquainted with a phoſphorus which had its light neither from the ſun nor from fire, but which, when heated on a metal plate

* The greater part of thoſe paſſages in the ancients which relate to this ſubject have been collected by Du Fay, Boſe and Cohauſen. See a paper on the light of diamonds in *Phyſiſchen abhandlungen der Pariſer academie*, xi. p. 38. *Diſcours ſur la lumière des diamans*, publiſhed at Gottingen in 1745; and *Lumen novum phoſphoris accenſum, a Cohauſen.* Amſtel. 1717, 8vo.

over

over glowing coals, ſhone with a blueiſh white luſtre; ſo that by ſtrewing the powder of it over paper, one might form luminous writing. I doubt much whether this experiment was ever tried; at leaſt I find no farther account of it in the papers of the ſociety, nor in the re-publication of the above author's firſt diſſertation, which appeared in 1681 *.

As far as I know, Kirchmaier, profeſſor at Wittenberg, was the firſt who diſcloſed the ſecret, in the year 1679 †. Both call this phoſphorus the

* Joan. Sigiſm. Elſholtii De phoſphoris quatuor obſervatio, Berolini 1676, one ſheet quarto. Alſo *De phoſphoro liquido obſervatio*. Berol. 1677, half a ſheet quarto; and *De phoſphoris obſervationes, quarum priores binæ antea jam editæ, tertia vero prima nunc vice prodit*. Berol. 1681, two ſheets quarto. This edition contains both the firſt papers with ſome new obſervations. The firſt papers may be found alſo in *Ephemerid. ac nat. cur.* Dec. 1, an. 8. obſ. 13, p. 32. The paſſage relating to this ſubject is as follows: Phoſphorus ſmaragdinus. Is ſplendorem ſuum non ex ſolaribus radiis, aut ex illuminato aere colligens; ſed ex igne ipſo. Ejus ſcilicet particulam ſi laminæ argenteæ aut cupreæ imponas, adhibito carbonum ſubtus calore, ſplendorem ex cæruleo albicantem mox percipies, adeo ut, ſi materiam illam in notas aut literas digeſſeris, legere nitentem commode ſcripturam, poſſis. Quare vero tertio huic (phoſphoro) id nomen indiderim et qua ratione parandus ipſe ſit, alteri ſervo occaſioni.

† Ante annos paucos admodum inventus mineralis alicujus, viſu et proprietatibus in quibuſdam ſimilis ſmaragdo, ab artificibus duobus mihi peramice notis uſus eſt. Conficiendi phoſphori

the ſmaragdine; becauſe the ancients ſpeak much of luminous emeralds; and becauſe green ſparry fluor is often exhibited as an emerald. Kirchmaier calls this mineral alſo *heſperus* and *veſperugo*; and theſe names have been often given ſince to ſparry fluor, as in the receipt before mentioned for making a liquid to etch on glaſs. Kirchmaier's information, however, muſt have been very little known; for the Jeſuit Caſatus, who, in 1684, wrote his Treatiſe on Fire, was not acquainted with it, as he has inſerted only the words of Elſholz *. This obſervation muſt have been new to Leibnitz himſelf, and to the Academy of Sciences at Berlin, in 1710; for the former then

phori et repræſentandi modus levis atque brevis ille. Recipe q. v. mineralis viridis ſmaragdum pene referentis; contere in pulverem, aqua madefac communi, pulvis inſtar ut fiat. Pencillo poſtea in lamina cuprea, magnitudine vel orbis, vel majoris plani alicujus manubrio inſtructa literas, quaſcunque voles, in lamina deſcribe craſſiuſculas. Ardentibus ſuper impone prunis vaſculo exceptis. Phænomenon ſpectabis in obſcuro amœniſſimum, ſine fumo et odore lucens. Sed, ut verum fatear, nec uſum, niſi curioſi animi explendi, artificium hoc, neque diuturnitatem habet. Pectus ergo avidum ſciendi meliora ſatiare nequit, ſive *heſperus* vocetur, ſive *veſperugo*. *Geor. Caſp. Kirchmaieri De phoſphoris et natura lucis, nec non de igne, commentatio epiſtolica.* Wittebergæ, 1680. 4to. p. 7. This *heſperus* muſt not have been known to Thom. Bartholin in 1668; at leaſt it is not mentioned in his book *De luce*. Hafniæ 1669, 8vo.

* Diſſertat. phyſicæ de igne. Francof. et Lipſ. 1688. 4to. p. 353.

mentioned

mentioned it to the ſociety as a philoſophical novelty *.

I ſhall remark, in the laſt place, that the manufacturing of veſſels and ornaments of every kind from ſolid ſparry fluor was begun in Derbyſhire, in the year 1765 †. The articles formed of it are in England called ſpar ornaments, and ſometimes *blue-john*. Many beautiful colours muſt, as is ſaid, be brought forward by means of fire. But the heat muſt be applied with great caution; for ſparry fluor, as is well known, by a ſtrong and particularly a ſudden heating, cracks, and loſes its tranſparency.—Since writing the above, I find that Mr. Raſpe ‡ denies this bringing forward of colours by fire.

* Miſcellanea Berolin. 1710. vol. i. p. 97: The ſparry fluor earth, or phoſphoric earth, as it is called, which, in latter times, has been found in marble quarries, and which ſome, at preſent, conſider as an earth ſaturated with phoſphoric acid, is mentioned by the Swede Hierne, in *Prodromus hiſt. nat. Succiæ*. Henkel had never ſeen it. See his *Kleine ſchriften*, p. 599.

† Watſon's Chemical Eſſays, ii. p. 277.

‡ A deſcriptive catalogue of engraved gems, by James Taſſie. London 1791. 2 vol. 4to. i. p. 51.

SOAP.

SOAP.

THAT the firſt expreſs mention of ſoap occurs in Pliny and Galen, and that the former declares it to be an invention of the Gauls, though he prefers the German to the Gallic ſoap *, has already been remarked by many. Pliny ſays that ſoap † was made of tallow and aſhes; that the beſt was made of goats' tallow and the aſhes of the beech tree, and that there were two kinds of it, hard and ſoft. The author of a work on ſimple medicines, which is aſcribed to Galen, but which however does not ſeem to have been written by that author, and of which only a Latin tranſlation has been printed, ſpeaks of ſoap being made by a mixture of oxen, goats', or ſheep's tallow, and a lye of aſhes ſtrength-

* In thoſe works which were certainly written by Galen, I have found the word σαπων twice. It occurs in *De compoſitione pharmac. ſecundum locos*, ii. 2. p. 279, and lib. v. cap. 5, p. 323: σαπωνος γαλλικου λιτραν μιαν.

Plin. xviii. 12. ſect. 51. p. 475: Sevum caprinum cum calce - - - Prodeſt et ſapo; Galliarum hoc inventum rutillandis capillis. Fit ex ſebo et cinere. Optimus fagino et caprino; duobus modis, ſpiſſus ac liquidus. Uterque apud Germanos majore in uſu viris quam feminis.

† It is beyond all doubt that the words *ſapo* and σαπων were derived from the German *ſepe*, which has been retained in the low German, the oldeſt and original dialect of our language. In the high German this derivation has been rendered a little more undiſtinguiſhable by the *p* being changed into the harder *f*. Such changes are common, as *ſchap, ſchaf; ſchip, ſchiff*, &c.

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ened with quicklime. He ſays the German ſoap was the pureſt, the fatteſt, and the beſt, and that the next in quality was the Gallic *. This account correſponds more exactly with the proceſs uſed in Germany at preſent; whereas the French uſe mineral alkali, and inſtead of tallow employ oil, which appears to be a later invention. Pliny in his deſcription does not ſpeak of quicklime; but as he mentions a mixture of goats' tallow and quicklime a little before, it is probable that the uſe of the latter was then known at Rome. Gallic and German ſoap are often mentioned by later writers †, as

* Sapo conficitur ex ſevo bubulo vel caprino aut vervecino, et lixivio cum calce; quod optimum judicamus Germanicum; eſt enim mundiſſimum et veluti pinguiſſimum, deinde Gallicum. Verum omnis ſapo acriter relaxare poteſt, et omnem ſordem de corpore abſtergere, vel de pannis, et exſiccare ſimiliter ut nitrum vel aphronitrum, mittitur et in cauſtica. *De ſimplicibus medicaminibus*, p. 90. G. In another book, aſcribed to Galen, the greater part of which is taken from Aëtius, and of which a Latin tranſlation only remains, *De dynamidiis*, p. 28. G, according to Geſner's edition ſtands: *Recipe ſaponem ſpatarenticum*, and p. 31. C, *emplaſtrum de ſapone ſpathulano*. Theſe epithets, in my opinion, ſignified ſoap which was ſo ſoft that it could be ſpread.

† The paſſages with which I am acquainted are as follows: *Theodor. Priſcianus*, lib. i. cap. 3. De crementis capillorum - - - Attamen Gallico ſapone caput lavabis. *Saponatum* occurs alſo lib. i. 18. *Sammon*, cap. 12. ver. 155: Attrito ſapone genas purgare memento. *Plin. Valer.* i. 23: Gallicus ſapo; and cap. 21: Saponarius, which word Barth in his *Adverſaria*, p. 1671, tranſlates a retailer of ſoap. *Paul. Ægin.* lib. vii. in the alphabetical catalogue of drugs, p. 639: σαπων ξυπτικης δυναμεως. Sapo exterſoriam

as well as by the Arabians*, ſometimes on account of their external uſe as a medicine, and ſometimes on account of their uſe in waſhing clothes. The latter purpoſe is that for which ſoap is principally employed in modern times; but it does not ſeem to have been the cauſe of German ſoap being introduced at Rome. Waſhing there was the occupation of indigent ſcourers, who did not give themſelves much trouble concerning foreign commodities. The German ſoap, with which, as Pliny tells us, the Germans coloured their hair red, was imported to Rome for the uſe of the faſhionable Roman ladies and their gallants. There is no doubt that the *pilæ Mattiacæ*, which Martial recommends as a preventative of grey hair †; the *cauſtica*

ſoriam vim habet. *Aretæus De diuturnis morbis*, ii. 13. p. 98: Ad curationem elephantiaſeos ſunt medicamenta innumera Celtarum, quos hac tempeſtate Gallos vocant. Nitroſis quoque illis factitiis globis, quibus velaminum ſordes expurgant, ſaponemque vocant (*the ſoap therefore appears to have been formed into balls*), illis globis corpus in balneo detergere optimum eſt. *Aëtius De arte med.* vi. 54. and xiii. 126, Stephanus quotes from the ſcholiaſt of Theophraſtus the diminutive σαπωνιον. The paſſage may be found *Idyl.* iii. 17. according to the edition of Reiſke, p. 51: Σμηχω τὸ καθαιρω, ἐξ ὁυ σμηγμα το σαπωνιον. Trallianus: Γαλλικου σαπωνος αναλυσας εν τῳ χυλῳ.

* Serapio, according to Brunfel's edition, cap. 348: Sapo eſt bonus ad maturandum apoſtema - - -*Raſes De ſimplic.* p. 397: Sapo calidus exiſtit, qui ulcerans corpus, in ipſo fortem efficit abſterſionem.

† Mart. xiv. 27. This ſoap acquired the epithet of *Mattiacum* from the name of a place which was in Heſſe.

ſpuma with which the Germans dyed their hair *; and the Batavian foam or lather which the Romans employed for colouring theirs †, were German ſoap. It is probable that the Germans tinged it with thoſe plants which were ſent to Rome for dyeing the hair ‡; and according to the modern man-

* Cauſtica Teutonicos accendit ſpuma capillos,
Captivis poteris cultior eſſe comis. *Mart.* xiv. 26.

Theſe lines are generally explained in this manner. "Dye thy hair with ſoap, and it will become more beautiful than that of the Germans." But in this caſe all the wit of the advice is loſt; and the expreſſion *eris cultior quam comæ captivæ*, ſeems to me to be very improper. I ſhould rather tranſlate them as follows: "Let the Germans dye their hair with pomade; as they are now ſubdued, thou mayſt ornament thyſelf better with a peruke made of the hair of theſe captives." This was a piece of delicate flattery to Domitian and the Roman pride. That prince thought he had conquered the Germans; and the moſt beautiful German hair, that which was not dyed, could be procured, therefore, at Rome, much eaſier than before. If the title of this epigram was written by Martial himſelf, it contains the firſt mention of the word *ſapo*.

† Fortior et tortos ſervat veſica capillos,
Et mutat Latias ſpuma Batava comas.
Mart. viii. 23, 19.

The firſt line of the above proves that people then covered their heads, in the night time, with a bladder to keep their hair, after it was dreſſed, from being deranged; and a bladder was undoubtedly as fit for that uſe as the nets and cawls employed for the like purpoſe at preſent.

‡ Femina canitiem Germanis inficit herbis.
Ovidius De arte amandi, iii. 163.

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ner of ſpeaking, it was more properly a kind of pomade than ſoap.

It appears that the Romans at firſt conſidered hair-ſoap as an ointment made from aſhes; for we read in various paſſages of ancient authors, that the hair was dyed by means of aſhes, or an ointment made of aſhes and a certain kind of oil. It is however poſſible that they may have had ſuch an ointment, which undoubtedly would be of a ſaponaceous nature, before they were acquainted with the German ſoap, or that they imitated the German pomade with different variations * .

As ſoap is every where uſed for waſhing at preſent, a queſtion ariſes what ſubſtitutes were employed before it was invented. Thoſe with which

* Valer. Max. i. 5, p. 135 : Capillos cinere rutilarunt.
Ad rutilam ſpeciem nigros flaveſcere crines,
Unguento cineris prædixit Plinius auctor.
Q. Serenus, De medic. iv. 56.

Serenus ſeems to allude to a paſſage of Pliny xxiii. 2. p. 306, where he ſpeaks of an ointment made from the burnt lees of vinegar and *oleum lentiſcinum*. The ſame thing is mentioned in *Dioſcorides*, v. 132. p. 379. *Servius*, *Æn.* iv. quotes the following words from Cato: Mulieres noſtræ cinere capillum ungitabant, ut rutilus eſſet crinis. *Alex. Trallianus*, 1, 3, gives directions how to make an ointment for grey hair from ſoap and the aſhes of the white flowers of the *verbaſcum*. The *cinerarii*, however, of Tertullian, lib. ii. *ad uxor.* 8. p. 641, ſeem to have been only hair-dreſſers, who were ſo called becauſe they warmed their curling-irons among the hot aſhes.

I am acquainted I ſhall mention and endeavour to illuſtrate. They are all ſtill uſed, though not in general; and they are all of a ſoapy nature, or, at leaſt, have the ſame effects as ſoap; ſo that we may ſay the ancients uſed ſoap without knowing it.

Our ſoap is produced by a mixture of lixivious ſalts and tallow, by which means the latter becomes ſoluble in water. The greater part of the dirt on our linen and clothes conſiſts of oily ſweat or greaſe, or duſt which that greaſe attracts, and which either cannot be waſhen out, or can be waſhen out only very imperfectly, by water alone. But if warm water, to which lixivious ſalts have in any manner been added, is taken, and if dirty cloth be rubbed in it, the greaſy dirt unites with the ſalts; becomes ſaponaceous; and is ſo far ſoluble in water that it may be waſhed out. There are alſo natural juices which are of a ſoapy quality, in the ſtate in which we find them, and which can be employed in the ſtead of artificial ſoap. Of this kind is the gall of animals, and the ſap of many plants. The former being leſs ſtrong in its effects on account of its ſlimy nature, is uſed at preſent particularly for coloured ſtuffs the dye of which is apt to fade. As far as I know, however, it was not employed by the ancients *, but it is

* Plin. ii. p. 474, ſays: that ſpots of the ſkin may be removed by means of ox's gall. Maculas tollit fel tauri.

certain

certain that in waſhing they uſed ſaponaceous plants.

In the remoteſt periods, it appears that clothes were cleaned by being rubbed or ſtamped upon in water, without the addition of any ſubſtance whatever. We are told by Homer, that Nauſicaa and her attendants waſhed their clothes by treading upon them with their feet in pits, into which they had collected water *. The epithet black, which the poet gives to the water, might induce one to conjecture that it had been mixed with aſhes, which would convert it into a lye; but where were the aſhes to be found? Had they brought them along with them, the bard, where he before enumerates every thing that they carried with them, and even oil, would not have failed to mention them; and ſuch a conjecture is rendered entirely groundleſs by his applying the ſame epithet to pure water, in other places, where nothing can be ſuppoſed to have coloured it †. Water, when it ſtands

* — — — — — και εσφορεον μελαν ὑδωρ,
Στειβον δ'εν βοθροισι θοως εριδα προφερουσαι.
— — — — — et inferebant in nigram aquam;
Conſtipabant autem in ſcrobibus celeriter certamen proferentes. *Odyſſ.* vi. 91.

† Iliad. ix. 14. ὡστε κρηνη μελανυδρος, ἡ - - - - δνοφερον χεει ὑδωρ; Sicut fons nigræ aquæ, qui obſcuram fundit aquam. This compariſon is repeated in the ſame words, *Iliad*, xvi. 4. Theocritus alſo, *Idyll.* xvi. 62, ſays: ὑδατι νιζειν δολεραν ιοειδεϊ πλινθον; aqua nigra lavare impurum laterem.

in deep pits, reflects so few rays of light, that in a poetical sense it may very properly be called black.

We find however mention made at later periods of ashes, and a lye of ashes employed for washing; but, I think, very seldom, and I do not know how old the use of them may be. According to Pollux *, *konia*, mentioned by Aristophanes and Plato, was a substance used for washing; and he says expressly, that we are to understand by it a lye of ashes. This I mention for the sake of those, who, like me, place little confidence in the terms of art given in dictionaries †. With the above lye, oil and wine jars were cleaned ‡; and it was employed also for washing the images of the gods ||. The method of strengthening the lye by means of unslaked lime was known, at any rate, in the time of Paulus Ægineta §; but it appears that the Ro-

* Onomast. vii. 11, 39. p. 713, 714.

† For abundance of these I shall refer to Dioscorides, i. 186. p. 88. The clear lye which drops from the ashes was called κονια στακτη και διηθημενη (from διηθεω, percolo) In the *Geopon.* x. 29, p. 697, the lye of the baths is called κονια βαλανευτικη.

‡ Geopon vii. 6. p. 475. *Plin.* xiv. cap. 21. p. 727. *Columella*, xii. 50. 14. p. 818.

|| Sordescunt divi, et ad sordes eluendas lavantibus aquis opus atque cineris frictione. *Arnobius*, vii. p. 237.

§ Lib. vii. Κονια, το οιον περιπλυμα της τεφρας ονομαζεται. Ει δε προσλαβοι και τιτανου η τιφρα, καυστικην εργαζεται την κονιαν, ην δη και πρωτοστακτον ονομαζουσι. Lixivium quasi lotura cineris. Si calcem assumat cinis, ustoria vi præditum lixivium facit, quod etiam πρωτοστακτον nominant.

mans

mans were not acquainted with the ſalt itſelf which is procured by diſſolving common wood-aſhes in water: I mean, they did not underſtand the art of producing it in a dry ſolid form, or of boiling potaſhes.

On the other hand, that fixed lixivious ſalt, the mineral which nature preſents in many of the ſouthern countries, was long known and uſed in waſhing. This was the *nitrum*, or, as the people of Attica pronounced it, the *litrum*, of the ancients, as has already been remarked by others *. It would however be worth the trouble to inveſtigate the proofs ſtill farther. By examining them with more mineralogical and chemical knowledge than have hitherto been employed for that purpoſe, they might be farther ſtrengthened, and ſerve to illuſtrate many obſcure paſſages. For my part, I have neither leiſure nor room here to undertake ſuch a taſk, though I have collected many obſervations relative to that ſubject. It is certain at any rate, that the ancients employed *nitrum* for waſhing, and it is evident from the teſtimony of various authors, that it was much uſed in the baths †.

* The word λιτρον in Pollux, x. 31, 135. p. 1317, ought not to have been tranſlated *ſapo*.

† Cicer. Epiſt. famil. viii. 14. *Cypriani Epiſt.* 76. *Pollucis Onom.* viii. 9, 39. p. 713, 714. x. 135. p. 1317. *Athanaſ. De virginitate*, i. p. 827. ed. Comelin. *Ovid. De medicam. faciei*, ver. 73 et 85. *Phavorini Dictionar.* p. 527: Νιτρον σαπωνιον, ἡ ειδος ιατρικον, παρατο νιζω. Gyneſius calls clothes waſhed with *nitrum*, νιτρουμενα, nitro perfricata.

That the people of Egypt, in the time of Pliny, made mineral alkali alſo from the aſhes of ſome plants, we have reaſon to conclude, becauſe he ſays that it was neceſſary to put the Egyptian nitre into veſſels well corked, elſe it became liquid *. Natural alkali is never liable to do ſo, unleſs it be very much burnt; and as no reaſon is aſſigned for its aſſuming that form, we may believe that the Egyptian alkali was the ſtrongly burnt aſhes of thoſe plants which are ſtill uſed in Egypt for making ſalts, and perhaps the ſame with which the Spaniards were made acquainted by the Arabians, and which they cultivate for making ſoda.

Strabo ſpeaks of an alkaline water in Armenia, which was uſed by the ſcourers for waſhing clothes †. Of this kind alſo muſt have been the lake *Aſcanius*, which is mentioned by Ariſtotle ‡, Antigonus Caryſtius ||, and Pliny §. It is worthy of remark, that the ancients made ointments of this mineral alkali and oil, but not hard ſoap, though by theſe means they approached nearer to the invention than the old Germans in their uſe of wood-aſhes; for dry ſolid ſoap can be made with

* Ægyptium in vaſis picatis affertur ne liqueſcat.

† Lib. xi. p. 801.

‡ De mirabil. auſcult. c. 54. p. 111.

|| Hiſtor. mirabiles, c. 162. p. 236.

§ Lib. xxxi. 10. p. 564.

more

more eaſe from the mineral than the vegetable alkali; and when Hungarian, French, and German ſoap are of equal goodneſs, the laſt does more credit to the manufacturers becauſe they cannot employ the mineral alkali. I ſhall here obſerve, that this alkali was uſed for waſhing by the Hebrews, and that it occurs in the ſacred writings under the name of *borith* ‡.

The cheapeſt, however, and the moſt common article uſed for waſhing, was the urine of men and animals. When this excrement becomes old, the alkali diſengages itſelf, which may be perceived by its fetid ſmell; and ſuch alkaliſed urine being warmed, and employed to waſh greaſy clothes, produces the ſame effects as the *nitrum* of the ancients. It is ſtill uſed for the like purpoſe in our cloth manufactories.

* J. D. Michaelis Commentationes. Bremæ 1774, 4to. p. 151. I muſt mention alſo *C. Schoettgenii Antiquitates fulloniæ*, added to his *Antiquitat. trituræ*. Traj. ad Rhen. 1727, 8vo. My readers will do me a pleaſure if they compare the above work with this article. No one will accuſe me of vanity when I pretend to underſtand the theory of waſhing better than the learned Schöttgen; but if I have explained the paſſages which he quotes, in a more ſatisfactory manner, and turned them to more advantage, I muſt aſcribe this ſuperiority to my knowledge of that art. I ſhall here take occaſion to remark, that there is no ſubject, however trifling, which may not be rendered uſeful, or at leaſt agreeable, by being treated in a ſcientific manner; and to turn ſuch into ridicule, inſtead of diſplaying wit, betrays a want of judgment.

To

To procure a ſupply of it, the ancient waſhers and ſcourers placed at the corners of the ſtreets, veſſels which they carried away after they had been filled by the paſſengers, who were at liberty to uſe them; and the practice of having ſuch conveniencies was certainly more decent than that of employing the walls of churches and other buildings, which the police of Dreſden forbade ſome years ago, but with no effect. At Rome, that which at preſent ſpoils and renders filthy our nobleſt edifices, was converted to uſe. When clothes were waſhed, they were trod upon with the feet, as is the caſe in the cloth-manufactories at Leeds, Halifax, and other places of England, where the urine is collected by ſervants, and ſold by meaſure to the manufacturers under the name of *old lant*. On account of the diſagreeable ſmell attending their employment, ſcourers at Rome were obliged to reſide either in the ſuburbs, or in ſome of the unfrequented ſtreets *.

* Plin. xxviii. 6. p. 466: Virilis urina podagris medetur, argumento fullonum, quos ideo tentari morbo negant. *Lib.* xxviii. 8. p. 459: Urinam camelorum fullonibus utiliſſimum eſſe tradunt. P. 459: Maculas e veſte urina ablui. *Martial.* vi. ep. 93. *Athen. Deipnoſ.* xi. p. 484: Fullones, abſtergendis veſtium ſordibus, eas urina madefaciunt. *Macrobius, Saturn.* ii. 12, ſpeaking of drunk people: Dum eunt, nulla eſt in angiporto amphora, quam non impleant, quippe qui veſicam plenam vini habeant. In the old editions this paſſage occurs, lib. iii. cap. 16, or, as Beroaldus ſays, cap. 17. It is quoted alſo in *Joh. Sareſberg. Polior.* viii. 7. p. 479.

My

My readers here will undoubtedly call to remembrance the ſource of taxation devi'ed by the emperor Veſpaſian, who, as his hiſtorians tell us, *urinæ vectigal c mmentus eſt* *. It is not certainly known in what manner this impoſt was regulated. Did the emperor declare that article, which was not *ſubterraneum rarius*, to be a regale as a *res derelicta*, ſo that the ſcourers were obliged to pay him what he thought a reaſonable ſum proportioned to the benefit which they derived from it? Or was it impoſed only as a poll-tax? For every tax upon any thing indiſpenſably neceſſary to all, is, to ſpeak in the language of finance, the ſame as what is called a poll-tax, or a tax paid by every one who has a head. The latter conjecture is the moſt probable, eſpecially as this tax continued two centuries, till the time of Anaſtaſius, and as we read alſo of *vectigal pro urina jumentorum et canum*, which was exacted from every perſon who kept cattle. Veſpaſian therefore was not fortunate in the choice of a name for his tribute, which on that account muſt have been undoubtedly more deteſted. A poll-tax at preſent is called by thoſe who do not ſpeak favourably of it, the Turkiſh-tax, becauſe the Turks impoſe it on all unbelievers. When it was introduced by Louis XIV, in 1695, he called it *la capitation*.

* Sueton. in Vita Veſpaſ. viii. 23. *Lipſius De magnitudine Romana.* The principal part of the information on this ſubject, in the latter, is taken from G. Cedrenus.

Of

Of plants with a ſaponaceous juice the ancients, at any rate, uſed one inſtead of ſoap; but it is difficult or rather impoſſible to define it. I ſhall not therefore content myſelf merely with tranſcribing the paſſages where it is mentioned; but I ſhall arrange whatever I can find reſpecting it in ſuch a manner, as, according to my opinion, the names of plants ought to be explained in dictionaries.

Στρουθιον, STRUTHIUM, Latinis HERBA LANARIA, et Plinio etiam RADICULA.

1. Eſt planta ſpinoſa, *Th. Pl.*
2. Grata aſpectu, ſed ſine odore, *Th. Pl.*
3. Folio oleæ, *Pl.* vel papaveris Heraclei, *Th.*
4. Caule ferulaceo, tenui, lanuginoſo, eduli, *Pl.*
5. Radice magna, acri, medicinali, *Pl. D.* ſpumeſcente, *Luc.*
6. Floret æſtate, *Th. Pl.* ſed ſemen nullum, *Pl.*
7. Naſcitur ſaxoſis et aſperis locis, *Pl.*
8. Sponte, præcipue in Aſia Syriaque; trans Euphratem laudatiſſima; ſativa ubique, *Pl.*
9. Radix conditur ad lanas lavandas, *Th. Pl. D. Col.* et alii.
10. Herba ovibus lac auget, *Pl.* *

The

* *Pl.* here ſtands for Pliny; *Th.* for Theophraſtus; *D.* for Dioſcorides;

The above is all that the ancients have told us reſpecting this plant. The information is indeed very ſcanty, and at the ſame time it is not altogether certain; but even if it were, it would be ſufficient only to confute ſome conjectures, but not to eſtabliſh the ſyſtematic name of the plant. I call the properties of it deſcribed to us uncertain: Firſt, becauſe I do not know whether Pliny did not mean to diſtinguiſh the wild plant from that which was cultivated, and many have underſtood as alluding to the former that which I have applied to both. Secondly, becauſe the words of Theophraſtus, being in one paſſage evidently corrupted, will admit of various conſtructions; and becauſe in an-

Dioſcorides; *Luc.* for Lucian; and *Col.* for Columella. The following are the paſſages alluded to:

Plin. xix. 3. ſect. 18. p. 161. xxiv. 11. p. 341; and 17. p. 352. xxix. 3. p. 500.

Theophraſti Hiſt. plant. vi. 7. p. 679. ed. Stap. vi. 3. p. 588. ix. 13. p. 1093. In the firſt paſſage it is ſaid: Herba lanaria dicta; flos aſpectu pulcer, ſed caret odore. According however to the common reading of the original it ought to be: Struthium dictum; flos adſpectu pulcer, et eſt odoratus autumno. Scaliger's emendation is: Struthium dictum, flos adſpectu pulcer, ſed ſine odore. Autumni floret lilii alterum genus. This is the more probable, as Pliny ſays in the ſame order: Grata adſpectu, ſed ſine odore.

Dioſcorid. ii. 193. p. 156. Notha. p. 447.

Lucianus, in Alexand. cap. xii. edit. Bipont. v. p. 75.

Columella, xi. 2. 35. p. 753: Radix lanaria.

It would appear that the ancients were acquainted with different kinds of *ſtruthium*; for *Celſus*, vi. 5. p. 346, names in a receipt *ſtruthium album*.

other, on account of ſome exceptions, of which he ſpeaks, they appear at leaſt to me unintelligible. Thirdly, becauſe Pliny, who gives us the beſt account of it, is the only author who calls the *ſtruthium* or ſoap-plant *radicula*, a name by which is rather to be underſtood a dye plant of the ſame kind as madder. We have reaſon therefore to ſuſpect that he has confounded the properties of the two plants, eſpecially as the fourth property was aſcribed by others to a *rubia*, *aſperula*, or *galium*, which was cultivated in Syria, and named often *radicula Syriaca*. On the other hand, this diminutive is very ill ſuited to a root which Pliny himſelf calls large.

The words of that author, *tingenti, quicquid ſit cum quo decoquatur*, have been by ſome explained, as if he meant that the *ſtruthium* was a dye-plant, though as a ſoapy plant it muſt have been deſtitute of colour; and they have hence deduced a proof that Pliny confounded the *ſtruthium* with the *radicula* uſed in dyeing. On the other hand, Hardouin reads *unguentis* inſtead of *tingenti*. He aſſures us that he found the former in manuſcripts, and is of opinion that the ſap of the *ſtruthium* was uſed alſo for ointments.

In my opinion, however, *tingenti* muſt be retained; and the meaning is that when cloth was to be dyed it was neceſſary to prepare it for that purpoſe by ſoking it and waſhing it with the ſap

of this plant. This he expreſsly tells us himſelf: *tingentibus et radicula lanas præparat.* It is probable that the ancient dyers mixed their dye-liquors with the juice of the *ſtruthium*, for the ſame purpoſe as bran and the ſeeds of fenugreek are added to dye-liquors at preſent; that is, to render them thicker and ſlimier, in order that the colouring particles may be longer and more equally ſuſpended in or diffuſed through them *. The words *quidquid ſit cum quo decoquatur* will now become intelligible. Whatever may be employed for dyeing, ſays the author, the addition of the juice of the *ſtruthium* is ſerviceable.

As what has been ſaid contains nothing that can enable us to determine the genus of the *ſtruthium* according to the rules of botany, we may be allowed to conjecture that it was one of thoſe plants ſtill uſed for the like purpoſe in Italy and other neighbouring countries. Fuchs thinks it muſt have been the *ſaponaria officinalis* (ſoap-wort), the roots of which indeed contain a ſaponaceous juice that readily changes the ſpittle into foam. The root was employed for that purpoſe by the impoſtor in Lucian; and the juice is uſed at preſent for cleaning wool and cloth. In the Helvetian Alps, the ſheep are waſhed with a decoction of the plant and its roots before they are ſhorn; and with a

† Porners Anleitung zur Farbekunſt, p. 31.

mixture

mixture of aſhes it ſerves for cleaning linen *. The taſte of it is ſo ſharp, that it is compared by ſome to that of the ſmall burnet-ſaxifrage †.

This *ſaponaria officinalis*, however, differs too much from the remaining properties ‡ of the *ſtruthium*. Its root is as thick only as a quill, or at moſt as one's finger. The ſtem, which is three feet in height, throws out many branches, and cannot be called *caulis ferulaceus, tenuis*. It is not rough and prickly, and, inſtead of growing in poor, rocky ſoil, it is rather fond of deep ground, and the borders of corn-fields.

We may, therefore, conjecture with more probability that the *gypſophila ſtruthium* LINN. || a plant ſtill

* Bock, Kräuterbuch, p. 296. *Storr, Alpenreiſe*, ii. p. 185. *Bergius, Mater. med.* p. 371. *Böhmers Techniſche geſchichte der pflanzen*, i. p. 774.

† Cartheuſer, Diſſertat. de radice ſapon. 1760.

‡ Thoſe numbered 3, 4, 5, 6.

|| This plant belongs to thoſe European vegetable productions which have not yet been completely deſcribed, and of which accurate figures have not been given. It was ſent by Imperati to Caſp. Bauhin, under the name of *lanaria veterum*; and the latter made it firſt known in his *Pinax plant.* iv. p. 206. The former deſcribed it himſelf, and gave a bad engraving of it, in *Hiſt. nat.* p. 871. Löfling found this plant on the Spaniſh mountains, as well as in the neighbourhood of Aranjues; and he relates, that in the province of la Mancha the people boil clothes that are to be waſhed, with

ſtill uſed for waſhing in the lower part of Italy and Spain, is the *ſtruthium* of the ancients. This opinion acquires ſome ſtrength by its being adopted among the Italians and the Spaniards; and becauſe the plant, as Pliny ſays, grows in a rocky ſoil and on the mountains. It is alſo ſtill called *lanaria* by the Calabrian peaſants. It has a tender ſtem; its leaves are ſo like thoſe of the olive tree that they might be compared to them by thoſe who are not botaniſts; and its root is large, but it is neither rough nor prickly. This contradiction may be accounted for by ſuppoſing that Pliny, through a miſtake, of which I have already accuſed him, aſcribed falſely to the ſoap-plant the prickly or rough leaves of the dye-plant which had an affinity to madder. But even after this explanation there ſtill remains to be got over a dubious paſſage of Theophraſtus, who, indeed, ſeems to make the plant prickly alſo.

I do not, therefore, place entire confidence in this opinion; but ſuſpect rather that we ſhall re-

with the root of this plant *inſtead of ſoap*. (The three laſt words, however, appear to have been added by his tranſlator.) *Reiſebeſchreibung*, p. 105. Linnæus did not heſitate to declare the *ſtruthium* of the ancients and the *ſtruthium* of his ſyſtem to be the ſame plant; and he gave his countrymen reaſon to hope that their *gypſophila faſtigiata*, which has a great reſemblance to it, might be employed in the like manner. *Amœnitat. Academ.* v. p. 329.

ceive from the Eaſt an account of a plant, ſtill uſed there, which will correſpond more exactly with the ſoap-plant deſcribed by Pliny. I am inclined to think that I have already found ſome precurſory information reſpecting it in Bauhin *, who ſays that, in Syria, there is another kind of ſoap-plant, which has prickly leaves like the thiſtle, and a thick root of a ſharp acrid taſte. The root, he adds, was employed for waſhing clothes and wool; and the confectioners of Damaſcus formed of it, with honey and wine, a kind of ſweetmeat which appeared as white as if it had been made of the fineſt flour and ſugar, and which was ſo hard that it could ſcarcely be broken with the teeth. This plant ſeems to belong to thoſe, the cultivation of which was abandoned in Europe, after the uſe

* Bellunenſis radicem eſſe ſcribit plantæ foliis ſpinoſæ carduorum modo, craſſitie pollicis, intus ſubflavam, nigram foris, odore et guſtu acrem; ejus decocto lanas laneoſque pannos ſordidos abſtergi. Damaſcenos ſeplaſiarios ejus decoctum immiſcere confectionibus paratis e melle ac ſapa, idque candoris tantum conciliare, ut ex amylo et ſaccharo puriſſimo conſtare videantur; quin etiam ſic durare, ut tenaciores ſint, et vix morſu divellantur. Conſtat, ejus radice in globos coacta, Syros veſtium, linteorum et induſiorum ſordes ac inquinamenta eluere, ſaponis aut lixivii modo. *Hiſtor. plant.* xxix. 43, p. 347. This account was too unintelligible to be introduced by Tournefort or Linnæus into their ſyſtems. But who was this *Bellunenſis?* In my opinion, the perſon meant is Andreas Bellunenſis, who wrote *gloſſemata* on Avicenna, and who is ſometimes quoted, and praiſed, by Conrade Geſner, on account of his acquaintance with the Arabic.

of

of them was rendered ſuperfluous by newer diſcoveries.

That the ancients employed their *ſtruthium* for waſhing wool is confirmed by various authorities*; but I do not remember to have found any evidence of its being uſed for cleaning clothes which had been worn. Saumaiſe, however, quotes a paſſage from the works, unfortunately never printed, of the old chemiſt Zoſimus, in which he gives directions for reſtoring, by means of the ſoap-plant, the luſtre of pearls which have become yellow †.

As the ſap of moſt plants is ſaponaceous, the meal of many kinds of grain may be uſed for waſhing, as well as various kinds of bran. That of almonds, which on account of its oil is remarkably ſoft, is employed at preſent for waſhing the hands by thoſe who are deſirous of having a white delicate ſkin. Cloth, the colours of which eaſily fade, and which will neither endure ſoap nor hard rubbing, may be waſhen extremely well with bran. Our fullers, therefore, and ſtocking-manufacturers

* Beſides the teſtimony of the before-quoted authors, may be mentioned that of Heſychius and Iſidore. Pliny, p. 500, calls waſhed wool: *lana radicula curata.* To be waſhed with it was ἐρυθιζεσθαι.

† Salmaſ. ad Solin. p. 818. a.

uſe oat, barley and bean-meal, eſpecially when they wiſh the cloth to be ſlowly milled *. Whether the ancients employed bran in the ſame manner I have not had an opportunity of examining. I am rather inclined to think that they did; and I can at any rate quote a paſſage of Galen, which ſeems to allude to the uſe of bean-meal †. In all probability, the beans of the ancients were the ſmalleſt and roundeſt variety of our horſe-beans, or thoſe uſed as fodder ‡.

In the laſt place, the ancients, at thoſe periods of which I ſpeak, uſed fullers-earth much oftener than it is uſed at preſent. Till the countries where

* See Phyſikal. œkonom. biblioth. xiv. p. 478.

† De alimentor. facultate, i. cap. 19, according to the Greek edition of Baſle, vol. iv. p. 315: Την δ'ουσιαν ου πυκνην και βαρειαν, αλλα χαυνην τε και κουφην εχουσιν οι κυαμοι, και τι ῥυπτικον εχουσαν ομοιως τη πτισσανη. Φαινεται γαρ εναρδως τα εξ αυτων αλευρα τον ῥυπον αποσμωντα του δερματος, ὁ καταγνοησαντες οι τ' ανδρωκαπηλοι και γυναικες οσημεραι χρωνται τω των κυαμων αλευρω λουμενας, καθαπερ αλλοι νιτρω τε και αφρονιτρω και ολως τοις ῥυπτικοις. Επιχριουσι δε και το προσωπον αυτων παραπλησιως τη πτισσανη. Habent fabæ ſubſtantiam non denſam nec gravem, ſed fungoſam ac levem; quæ vim quandam, quomodo ptiſana, habet detergendi. Apparet enim perſpicue ipſarum farina ſordes a cute detergere, quod mangones ac mulieres intelligentes, in balneis quotidie fabarum farina utuntur, quemadmodum alii nitro atque aphronitro et in ſummo detergentibus. Hac propterea et faciem inungunt, quemadmodum ptiſana. *Edit. Geſneri*, claſ. 2. p. 26.

‡ See Phyſikal. œkonom. biblioth. xvi. p. 213.

it was procured be deſcribed by travellers who unite a knowledge of antiquities with ſkill in mineralogy, the ſpecies of this earth, mentioned in the works of ancient authors, cannot be diſtinguiſhed with accuracy. But from the purpoſes to which they were applied we can with certainty conclude that they muſt have been partly of the nature of marl and partly of the nature of the ſoap-rock.

According to the then uſual method of waſhing, by which the clothes were ſtamped with the feet *, the *cretæ fullonicæ*, as Pliny † calls them, acted in the ſame manner as our fullers-earth employed at preſent, partly by ſcouring and partly by abſorbing the greaſy dirt. The ancients, after their manner, gave them names only from the countries where they were produced; and hence we find mention made of *terra Cimolia* ‡, *Chia* ||, *Lemnia* §,

* A paſſage of Titinnius, quoted from *Nonius Marc.* iv. 34. p. 623, in *Gothofredi Auct. ling. Lat.* which Schottgen reads in the following manner, may ſerve as a proof:

— — — terra hæc non aqua
Ubi tu ſolitus pedibus argutarier;
Dum compeſcis cretam, et veſtimenta eluis.

† Lib. xvii. 18, p. 54.

‡ Pollux, vii. 11, 39, p. 714. Plin. xxxv. 17. p. 718.

|| Dioſcor. v. 174, p. 391. Χια σμηχει αντι νιτρου εν βαλανειῳ.

§ This *terra Lemnia* is entirely different from ſealing-earth. See *Galen. De ſimplic. medic. facultat.* ix. p. 133. ed. Geſneri.

Sarda *, *Umbria* †, *Samia*, *Tymphæa* ‡, and others. Many of them, like that brought from Sardinia, could not be uſed in cleaning coloured ſtuffs; and for this reaſon, perhaps, becauſe ſome colours would not ſtand hard ſcouring, or endure their cauſtic nature.

The fullers, however, did not uſe theſe earths merely for waſhing, but alſo for whitening many kinds of cloth. This was done by rubbing fine white earth into the cloth, in the ſame manner as ſoldiers do to give ſome parts of their dreſs a brighter appearance. A like proceſs is employed by glovers and thoſe who waſh or clean leather. The earth uſed by the latter is a yellowiſh white iron-ochre, called, from the purpoſe to which it is applied, collar-earth ||. When a perfect white was required, a kind of white potters-clay or marl was employed; and the cloſer it adhered to the

* Plin. p. 718.

† Plin. l. c. The *Sarda* was cheap, and purchaſed by meaſure; the *Umbria* was dearer, and ſold by weight.

‡ Theophraſt. De lapid. § 109. *Dioſcorides*, v. 152, p. 387, ſays alſo of the *morochthus*: ᾧ καὶ οἱ οἰνοποιοὶ πρὸς λευκωσιν τῶν ἱματίων χρῶνται.

|| I here mean that it got its name from being employed to clean that piece of armour, formerly uſed, which covered only the breaſt and the back, and which was called a *koller*. The Swedes alſo call yellow iron-ochre *kiöllerfärg*, or *kyllerfarg*. See *Waller. Min.* ii. p. 258.

cloth,

cloth, and the leſs eaſily it could be rubbed out, it was ſo much the better. The poor people at Rome rubbed it over their clothes on feſtivals, in order that they might appear brighter *.

It deſerves here to be particularly remarked, that ſome of theſe earths, ſuch as that of Chios, were employed in the baths inſtead of nitrum †; and this is the caſe in the Levant ſtill. De la Valle ‡ extols, in this reſpect, a kind of reddiſh earth, and ſays that people of the firſt diſtinction never bathe without it. Perfumes are often mixed with it; and it is formed into ſmall balls which, when uſed, are ſuffered to diſſolve in the water. Different kinds of veſſels, and particularly thoſe in which wine and oil had been kept, were cleanſed with theſe earths alſo ||. Glaſs flaſks, which have had oil in them, cannot be cleanſed better or more ſpeedily than by ſhaking in them a mixture of fullers-earth or potters-clay. When theſe are not to be had, filtering-paper may be uſed. The oil is abſorbed by the earth or the paper, and with them can be eaſily waſhed out.

* See Taubmann's Annotations to *Plauti Aulular*, iv. ſc. 9. 6: Qui veſtitu et creta occultant ſeſe, atque ſedent quaſi ſint frugi.

† Dioſcorid. v. 174.

‡ Reiſe, i. p. 217.

|| Geopon. vii. 6, p. 475. *Plin.* xiv. cap. 21, p. 727. *Columella*, xii. 50, 14, p. 818.

To render cloth perfectly white, it was alſo fumigated with ſulphur by the fullers, who were not ignorant that many colours were deſtroyed by the volatile ſteam of that ſubſtance *. We are told by Apuleius that the wife of a ſcourer concealed her gallant under a veſſel of baſket-work, over which cloth uſed to be laid to whiten by the effects of ſulphur kindled under it †. Our waſher-women employ for the ſame purpoſe a caſk ‡, and our clothiers a ſmall cloſe apartment, in which the wet cloth is ſuſpended upon hooks.

Pliny has deſcribed the method of waſhing uſed at Rome, but many things reſpecting it appear to me obſcure ||. The cloth was firſt waſhed with Sardian

* Pollux, vii. 11, 41. 715. *Plin.* xxxv. 17, p. 719; and xxxv. 15, p. 714: Tertio generi ſulphuris unus tantum eſt uſus ad ſuffiendas lanas, quoniam candorem tantum mollitiemque confert. - - - *Iſidor. Origin.* xvi. 1.

† Ergo noſtra repente turbata præſentia, ſubitario ducta conſilio, eundem illum ſubjectum contegit viminea cavea, quæ fuſtium flexu in rectum aggregata cumulum, lacinias circumdatas ſuffuſa candido fumo ſulfuris, inalbabat. *Apul. Metamorph.* ix. p. 292.

‡ I hope my readers will not miſunderſtand me. I mean for fumigating clothes with ſulphur, and not for concealing a gallant.

|| Ordo hic eſt. Primum abluitur veſtis Sarda, dein ſulphure ſuffitur; deſquamatur Cimolia, quæ eſt coloris veri. Fucatus enim deprehenditur, nigreſcitque et funditur ſulphure. Veros autem

et

Sardian earth; it was then fumigated with ſulphur, and afterwards rinſed with real Cimolian earth. The word *deſquamatur* was undoubtedly a term of art which cannot be farther explained, becauſe we are unacquainted with the operation to which it alludes *. Pliny ſeems to have been particular in mentioning real Cimolian earth, becauſe the falſe kind became black by the ſteam of the ſulphur which the cloth abſorbed. Was it adulterated with ſome metallic earth or with white lead? It was dear enough to induce people to mix it with ſuch articles; and in that caſe it muſt neceſſarily have become black.

The expreſſion *funditur ſulphure* ſeems to be attended with no leſs difficulty. In comparing the different readings, I find that the oldeſt editions have *offunditur*, which has been changed into

et pretioſos colores emollit Cimolia, et quodam nitore exhilarat contriſtatos ſulphure. Candidis veſtibus ſaxum utilius a ſulphure, inimicum coloribus. Græcia pro Cimolia Tymphaico utitur gypſo. *Lib.* xxxv. cap. 17. ſec. 57, p. 719.

* Imperati gives the following explanation of this word in *Hiſt. nat.* iv. 48, p. 137: Deſquamatio, quam Cimolia gypſove Tymphaico fieri Plinius docet, idem eſt cum ea operatione quæ nunc fit gypſo communi in pannis fumo obductis. - - - Quædam terræ uſurpantur ſiccæ, ut gypſum, ad fumum e pannis excutiendum; namque ſi illis locus fumo infectus fricetur, gypſum cum fumo unitur, denuoque excuſſo panno, fuligo pannis adhærens ſimul excutitur. Huic itaque miniſterio inſervit gypſum ſimpliciter coctum, inquinatum et ſiccatum.

effunditur,

effunditur, and laſtly, into *funditur* *. It is probable, however, that inſtead of *offunditur* we ought to read *offenditur*, which would make the whole clear. I am much ſurpriſed that this reading was not adopted by Hardouin. As Pliny ſays in other parts of his work *offendit ſtomachum*, and *offendit aciem oculorum*, he might, undoubtedly, have applied that word to the earth and its colour.

Faſt colours, which the acid of ſulphur might render pale, but could not entirely deſtroy, would by waſhing with Cimolian earth be improved, or rather reſtored, as the earth would abſorb and carry off the acid. There was alſo another kind of earth *(ſaxum)* which was uſeful in the preparation of cloth fumigated with ſulphur, but which injured the dye, probably, becauſe it was too calcareous, and which was perhaps our common chalk.

I do not intend to treat here of the whole art of the Roman fullers, which belongs rather to the hiſtory of weaving or manufacturing cloth in general; but I hope I ſhall be forgiven if I add the few following obſervations. The fullers received the cloth as it came from the loom, in order that it might be ſcoured, walked, and ſmoothed. It

* See the ſmall Elzevir edition, Lugd. Bat. 1635. 12mo. vol. iii. p. 575.

was walked by being ſtamped upon with the feet. The rough wool raiſed by this operation was combed off, partly with the ſkin of a hedge-hog, and partly with the tops of ſome plants of the thiſtle kind, in order to give the cloth a nap. Shearing ſeems not then to have been known: I have at leaſt met with no paſſage where it is mentioned: and the caſe is the ſame with the uſe of preſſes; which, in my opinion, were not invented till the ſixteenth century *. The whole proceſs of ſmoothing ſeems to have conſiſted in making the wool or nap lie as evenly as poſſible one way, which certainly muſt have given to the cloth a much better appearance.

As cloth, at preſent, is more dreſſed and ſhorn on one ſide than another, the ancient fullers prepared theirs in the like manner; ſo that clothes could be turned, after the inſide of them had been new dreſſed. Whether they made felt, alſo, I have not yet enquired; but I conjecture that the manufacturing it was the occupation of thoſe called *lanarii*, *coactores*, and *coactilarii* †.

The

* Schrevelii Harlemum, p. 296. The author, ſpeaking of cloth in the year 1522, ſays: Eodem hoc anno prelorum uſus cepit ad nitorem.

† The following explanation of ſome terms of art, employed by the ancients, will, perhaps, afford ſatisfaction to my readers:

Fullones, nactæ, κναφεις, ναχται, cloth-dreſſers. The word cloth-

The occupation of the fullers was, at Rome, very extenſive, and afforded employment to a great number of people, but it at length entirely decayed. Schottgen is of opinion that it belongs to thoſe arts which have been loſt. But other writers have declared arts which are exerciſed now in greater perfection than formerly to be loſt, merely

cloth-dreſſer ſeems to expreſs much better the employment of the ancient fullers than the word walker. For walking, properly ſo called, the Romans, as appears, had no particular term of art. The Greeks had κναπτειν and συμπατησαι; which words, like the German *durch-walken*, were uſed to expreſs beating or baſting: τη μαστιγι γναψειν ευ μαλα, η συμπατησαι. Pollux, p. 712. The Greeks ſay alſo πλυνειν for λοιδορειν to waſh one; to tell one an unpleaſant truth; to reproach or revile one.

Κναφος, an inſtrument uſed for dreſſing cloth. At preſent a wooden croſs planted with prickles (*ſpina fullonia*, Plin.). The σωρος may have been conſtructed in the like manner. If Saumaiſe has conjectured right, that inſtrument was called alſo *inea*; but the paſſage of Pliny, b. xix. 1, 3. p. 156, *pectitur ferreis hamis*, does not allude to dreſſing cloth, but to dreſſing flax, which requires an inſtrument of iron; and has more affinity to the combing or carding of wool than to the dreſſing of cloth.

Veſtes expolire, *polire*, to ſmooth cloth.

Veſtes pexæ, cloth walked and dreſſed.

Politura, γναψις, the ſmoothing.

Preſa tunica, the right ſide of the cloth, which had been completely ſmoothed.

Veſtes tritæ, worn cloth become threadbare.

Interpolire, *interpolare veſtes*, to dreſs anew. *Non. Mar.* i. 145: Eſt tractum ab arte fullonia, qui poliendo diligenter vetera quæque quaſi in novam ſpeciem mutant.

becauſe

becauſe they were not acquainted with them; or becauſe, on account of the alterations they have undergone, they did not know where to find them. All the different operations of fulling have become ſo complex by new methods, improvements, and inventions, that they can no longer be conducted by one man; and the whole buſineſs has, for that reaſon, been ſeparated or divided into ſeveral diſtinct branches.

The ſcouring of cloth, when it comes from the loom, was, together with walking, ſeparated from the reſt, after the invention of the walk-mill. How old that invention may be, I cannot accurately determine; but we find it mentioned in the beginning of the thirteenth, and even at the end of the tenth century. Such a mill formerly was called *fullencium*, or *molendinum cum fullone* *. The dreſſing and ſmoothing of cloth, ſince the invention of ſhearing and preſſing, requires ſo much art, that theſe operations can be performed only by ſkilful workmen, who are called cloth-ſhearers or cloth-dreſſers. The ſcouring of cloth, dirtied in manufacturing, is, by the invention of ſoap, bleaching, and other proceſſes, become ſo eaſy, that it can be performed by women. The Romans, for the moſt part, wore a white dreſs, made in the form of a cloak; which, indeed, as ſhirts were not

* Du Cange in his Gloſſarium.

then

then uſed, muſt have often ſtood in need of being cleaned *. We, on the other hand, wear in general ſhort cloſe clothes of coloured cloth; which, by the faſhion in which they are made, are leſs expoſed to be dirtied; and we are more accuſtomed alſo to uſe clothes of linen or cotton, which can be waſhen with much leſs labour. Felt, which is employed almoſt for hats alone, is manufactured by our hat-makers. Whoever takes a general view of all theſe employments together, will be readily convinced that they maintain more people, and in a better manner, than the whole *ars fullonia* did at Rome.

* I acknowledge to be one of thoſe who cannot form a proper idea of the Roman *toga*. It is certain that the weavers made each piece of cloth only ſo large as to be fit for this article of dreſs; or that when a *toga* was wove, it was cut from the loom, in order that another might be begun. On this account we find ſo often the expreſſions *texere veſtes*, *texere togas*. It appears, alſo, that the *toga*, when it came from the hands of the weaver, was quite ready for uſe; and we therefore never read of taylors, but when torn clothes were to be mended. The *toga* had no ſleeves, and perhaps no ſeam. If it was ſtitched along the edges before, half way up, the aſſiſtance of a taylor would not be neceſſary for that purpoſe. It was bound round the body with a girdle, and faſtened with claſps. Such a mantle could be eaſily made and eaſily ſcoured. One may now readily comprehend why the Roman authors never mention cloth manufactories, or cloth, among the articles of commerce, but ſpeak only of clothes; and why we never read of cloth being meaſured.

MADDER.

MADDER.

THIS plant, the root of which is either dried and bruiſed, or, according to the new method, uſed freſh, for dyeing red, has a weak, ſquare, jointed ſtem; and riſes to the height of eight feet when ſupported, otherwiſe it creeps along the ground. At each joint there are five or ſix leaves, about three inches in length, almoſt an inch broad in the middle, and pointed at both ends. The upper ſide of the leaves is ſmooth; but the middle fibre of the under ſide is armed with ſmall rough prickles; and others of the ſame kind may be found on the ſtem. On this account, the leaves, which drop annually, adhere readily to other bodies, like thoſe of the *aſperugo*. The branches, which, in June, bear flowers divided into four yellow leaves, proceed from the joints. The fruit, a kind of berry, which, towards the time of its ripening, though that ſeldom happens among us, is firſt of a browniſh colour, and then black, contains a round ſeed. The roots grow ſometimes to the thickneſs of one's finger, puſh themſelves deep into the earth, are ſurrounded by many ſmall fibres, have a yellowiſh-red pith, and are covered with

with a black bark or rind *. This plant grows wild in the Levant, as well as in Italy, the ſouthern parts of France, and in Swiſſerland. The cultivated kind is well known; and is propagated with much advantage in various countries of Europe.

When one compares this ſhort deſcription with what Dioſcorides ſays of a plant which he calls *ereuthodanon* †, it will be readily ſeen that he meant our madder. He even compares its long ſquare ſtem, armed with a great many hooks, to that of the *aſperugo*; and he tells us that the leaves ſtand in the form of a ſtar around the joints. The fruit was at firſt green, then red, and laſtly black. The thin long roots, adds he, which are red, ſerve for dyeing; and on that account the cultivated kind (he muſt therefore have been acquainted with the wild ſort) is reared with much benefit in Galilea, around Ravenna in Italy, and in Caria, where it is planted either among the olive trees, or in fields deſtined for that purpoſe. It is remarked in ſome manuſcripts, that this plant had a name given it by

* A complete figure of it may be ſeen in *Kerners Abbildungen der ækonomiſchen pflanzen*, tab. 236. Of the wild kind, which is ſmaller in all its parts, a figure is given in *Memorie di oſſervazioni ſopra la coltura di varie piante*. In Padova, 1766. 4to. tab. 9. p. 53.

† Ερευθοδανον. He calls it alſo ερυθροδανον. Lib. iii. cap. 160. p. 238 and 460.

the

the Romans, which, as Marcellus Virgil obſerves, meant the ſame thing as *rubia ſativa*; and that it was called in Hetruria *lappa minor*, doubtleſs becauſe, like the bur, it adhered to other bodies. On account of the dye which it communicated, it was called alſo ſometimes *cinnabaris* *.

In

* Some, alſo, may, with equal propriety, have called it *ſandyx*; and I am of opinion that under this name we are to underſtand our madder, at leaſt in a paſſage of Virgil, Eclogue iv. 45, where he ſays: Sponte ſua ſandyx paſcentes veſtiet agnos. As the wool of the ſheep became red by eating the madder which grew in the fields, it could be immediately manufactured, without dyeing it artificially. We manufacture the wool of our brown ſheep in its natural colour, and this was done alſo by the ancients. Cloths of this kind were the *panni nativi coloris*, as they are called by Pliny, b. xxxvi. 7; and the words of Martial, xiv. 133, allude to a dreſs made of ſuch cloth:

Non eſt lana mihi mendax, nec mutor aëno,
— — — — — — me mea tinxit ovis.

I ſhall here take occaſion to remark, that the word *lutum*, in the line preceding the above paſſage of Virgil, muſt be tranſlated *yellow-weed*, and not *woad*. The former, *reſeda luteola*, dyes yellow; but the latter, *iſatis*, dyes blue. *Lutum*, however, in *Cæſar De bello Gallico*, v. 14. ſeems to have been *woad*: Omnes ſe Britanni luteo inficiunt, quod et cæruleum efficit colorem. It appears, therefore, that both names were liable to be confounded in the Latin, as they are in the German; unleſs Davis be right, who, inſtead of *luteo*, reads *vitro*. That *ſandyx*, in Virgil, ſignifies a plant rather than a mineral, is to me far more probable. The author ſpeaks of plants which the ſheep ate while feeding (*paſcentes*); and both the above-mentioned dye-plants, yellow-weed and woad, grow wild in Italy. The opinion of Pliny, who underſtood the paſſage ſo, is not to be deſpiſed; and therefore

In oppoſition to this aſſerted identity I find only one doubt; which is, that among thoſe plants which, on account of the poſition of their leaves, were called *ſtellatæ*, and which were all ſo like that we muſt reduce them to one natural claſs, there are more ſorts, the roots of which dye red, and which are very improperly called wild madder *. Why, therefore, ſhould the plant of Dioſcorides be our madder, and not ſome other plant of the like nature? For this reaſon, in my opinion: becauſe the ancients, who were acquainted with all theſe plants, which grew wild in their lands, would be equally prudent as the moderns, and cultivate that kind only which was the moſt productive or beneficial, viz. our *rubia tinctorum*.

This opinion will be ſtrengthened by comparing the accounts given of that plant by other ancient writers. Theophraſtus † agrees almoſt perfectly with Dioſcorides; and adds, that it did

the poetical account, that the paſture dyed the wool, is not altogether without foundation; eſpecially as not only the roots, but alſo the leaves of madder, communicate a colour to the ſolid parts of animal bodies. I will however allow, that moſt people readily fall into the error of being led away by imagination; and often ſuppoſe that they find in paſſages of ancient authors more than others can diſcover, or perhaps even than they contain.

* See the catalogue in my Grundsätzen der landwirthſchaft, § 310.

† Hiſt. plant. ix. 24. p. 111.

not

not grow upright, but was fond of reclining. The compariſon, therefore, with the leaves of ivy, cannot be juſt; but that I ſhall leave to the critics *. Pliny ſays expreſsly, that the *erythrodanum* or *ereuthodanum* was in his mother tongue called *rubia*; and that its red roots were uſed to dye wool and leather red †.

In the middle ages this plant was called *varantia*, a name which muſt have ariſen from *verantia*. The latter means the real, genuine dye; as *aurantia* ſignified a golden yellow ‡. Till the year 1736 this plant was little regarded, except among dyers, farmers, and merchants, who purchaſed it

* Stapel reads ὁμοιον ὀχρῳ, becauſe Pliny, xix. 3. ſays, *ſimilitudine erviliæ*. In my opinion, Pliny in this compariſon alluded to the ſtem of the plant, which in madder is formed almoſt like that of many kinds of pulſe, and which reclines in the ſame manner; and he adds, very properly, that the ſtem of the *rubia* was jointed, and ſurrounded with five leaves, diſplayed in the form of a ſtar. His words are only not properly divided, and ought to be arranged as follows: Sponte provenit, ſeriturque. Similitudine erviliæ, verum ſpinoſus ei caulis.———If one could introduce the word ὀχεῳ into the paſſage of Theophraſtus, ſo as to retain this meaning, it would appear intelligible; but that would be difficult on account of the word φυλλον.

† Lib. xxiv. 9. p. 341.

‡ Flame colour among the Greeks was called αληθινον. Myrepſius ſays that the rubia τα αληθινα βαπτει, that is, dyes red. *Salmaſius ad Capitolini Macrinum*, p. 169, 170. *Ad Solinum*, p. 810.

from the farmers, in order to ſell it to the dyers with profit; and among a few herb-dealers and phyſicians, who, on the authority of the ancients, aſcribed to it eminent virtues, which others doubted or altogether denied. In the above year, however, a property of it was diſcovered, by accident, as uſual, which rendered it an object of more attention. John Belchier, an Engliſh ſurgeon, having dined with a cotton-printer, obſerved that the bones of the pork which was brought to the table were red. As he ſeemed ſurpriſed at this circumſtance, his hoſt aſſured him that the redneſs was occaſioned by the ſwine feeding on the water mixed with bran in which the cotton cloth was boiled, and which was coloured by the madder uſed in printing it. Belchier *, to whom this effect was new, convinced himſelf, by experiments, that the red colour of the bones had ariſen from the madder employed in printing the cotton, and from no other cauſe; and he communicated his diſco-

* The firſt account of this circumſtance may be found in the Philoſophical Tranſactions, vol. xxxix. n. 442. p. 287. n. 443. p. 299; and in the French tranſlation, *Tranſactions, traduites* par M. de Bremond, année 1736, p. 155 and 169. Among the principal experiments made on this ſubject, are thoſe of the Italian Matth. Bazanus and H. J. Benj. Böhmer. Thoſe of the former may be found in *Comment. Bononienſ.* ii. 1. p. 129, and 2. p. 124; and thoſe of the latter in a diſſertation entitled *Radicis rubiæ tinctorum effectus in corpore animali*, Lipſ. 1751. Other works and obſervations relative to this ſingularity are mentioned in Haller's *Elementa Phyſiologiæ*, v. p. 327.

very to the Royal Society, in a paper which was printed in their Tranſactions.

This ſingularity was now ſoon known to all the naturaliſts, ſeveral of whom made new experiments, the reſult of which brought to light many truths uſeful to phyſiology. Beſides the roots of madder, thoſe of the *galium* (yellow ladies-bedſtraw) and other plants which have an affinity to madder, produce the like effects; but this is the caſe neither with ſaffron nor woad, nor with many others much uſed in dyeing. The colouring takes place ſooneſt in young animals; and is ſtrongeſt where the bones are hardeſt and thickeſt. On the other hand it does not reach the ſoft parts; appears only a little in the milk; and, in general, is not perceptible in the animal juices*.

As

* That the *rubia* colours the milk has been denied by many, who are mentioned in *Haller's Phyſiol.* viii. p. 328. Young, in his Treatiſe *de lacte*, ſays only that it has no effect on carnivorous animals. Being once engaged in making experiments on the madder dye, I gave the plant to a cow for ſeveral days, and I found that the milk became reddiſh and ſtreaked with veins which were of a darker colour than the other parts. Stief alſo, whom I ſhall quote hereafter, ſpeaking of this plant, ſays, p. 11. Inde vaccarum lacti aliquid rubicundi coloris communicatur, quæ mutatio ex oppoſito lacte e mammis vaccæ alio pabulo enutritæ, magis apparet. Incolæ fere omnes Wratiſlavienſes eodem rubeſcente lacte utuntur, et nulla incommoda ſentiunt.—That well-known farmer, Gugenmus, gave the madder-plant, formed into

As the Engliſh calico-printers were acquainted with this effect of madder, before it was known to naturaliſts, it is not improbable that it was known much ſooner, in other places, where the plant has been much cultivated and uſed ſince the earlieſt periods. From what J. E. Stief ſays, we have reaſon to believe, that the people in the neighbourhood of Breſlau, his native city, who gave the ſtalks of the madder-plant to their cows inſtead of ſtraw, muſt have firſt diſcovered that it poſſeſſed the property of communicating a red colour to the bones*.

hay, to his cows, which ate it readily. Their milk was ſomewhat reddiſh, and the butter and cheeſe acquired by theſe means, in winter, an agreeable colour. See *Bemerkungen der Pfälziſchen ökonomiſchen Geſellſchaft.* 1771. p. 253. Perhaps the effects do not take place when the animals get other food at the ſame time. Or may not the ſtate of their health occaſion ſome difference? This much is certain, that *chelidonium* (ſwallow-wort) makes the milk of cows that are weak appear bloody, while the ſame effect does not follow, or at leaſt immediately, in thoſe that are ſtrong. *Ruellius*, *De natura ſtirpium*, Baſiliæ, 1543. fol. p. 572, ſays of the rubia: Folia capillum tinguut. If he meant that the hair became red by eating the leaves, he committed a miſtake; for Böhmer ſays, p. 17: Conſtanti et perpetua obſervatione cognovimus, quadrupedum pilos et ſetas nunquam a rubiæ radicis adſumptæ colore infectas fuiſſe. From his error, however, one might conjecture that he knew ſomething of the property which this plant has of communicating its colour when uſed as food. The firſt edition of his book was printed in 1536.

* Diſſertatio de vita nuptiiſque plantarum. *Lipſiæ*, 1741, p. 11.

As

As many truths not yet inveſtigated by means of new experiments, and which on that account have not yet been acknowledged, are concealed among the evidently falſe aſſertions to be found in the works of the ancients, and as theſe works were thrown aſide too early, before their contents were properly examined, I was induced to ſuſpect that ſome hints of this colouring property might alſo be mentioned in them, which indeed is the caſe.

We learn from the works of Galen and Dioſcorides *, that the ancient phyſicians remarked that the uſe of certain roots, which they adminiſtered to their patients, communicated a colour to their urine and excrements; and this obſervation has been repeated by Cardan †, Thurneiſſer ‡, Porta §, Caſtor Durantes ‖, and others. Had thoſe ancient phyſicians, who often preſcribed theſe roots, and paid attention to the colour of the excrements of their patients, been accuſtomed to open their bodies when

* Dioſcor. iii. 160. p. 238. Radix craſſam et copioſam urinam pellit, ac interdum etiam ſanguinem. Bibentes quotidie lavari oportet, et excrementorum quæ redduntur differentiam contemplari. *Galen.* lib. vi. *Simp.* One may readily perceive here that urine tinged red was conſidered as blood.

† De ſubtilitate. Baſiliæ 1664. 4to. lib. xviii. p. 669.

‡ Von kalten, warmen und metalliſchen waſſern. Straſburg, 1612. fol. iv. 6. p. 78.

§ Magia natural. Francof. 1591. 8vo. viii. 13. p. 355.

‖ Herbarium novum. Venet. 1617. fol. p. 400.

they died under their hands, they would have perhaps remarked, in human bones, what was obſerved long after in the bones of animals, when the roots were no longer uſed in medicine; and what, if I am not miſtaken, was never yet obſerved in the bones of the human ſpecies*.

Böhmer, who made reſearches reſpecting the antiquity of this obſervation, found it neither in Rombert. Dodonæus†, Mich. Ettmuller‡, Morin§, Will. Salmon‖, nor others, who, however, ſpeak of coloured urine. In his opinion the oldeſt writer who ſpeaks of coloured bones is Mizaldus; but

* I do not know that any one ever remarked human bones to have been dyed by madder, though the propoſal for uſing the roots of it againſt the rachitis might have given occaſion to make obſervations on that ſubject. See *G. L. Hanſen, Diſſ. de rachitide.* Gottingæ 1762, p. 36. Profeſſor Arnemann, who has a very numerous and valuable collection of ſkeletons, and who carefully examined many of the like kind during his travels, aſſured me that he never ſaw any bones that had been dyed by madder in the human body. He ſaid it was probable, however, that the colouring of the bones depends on the attractive power which the calcareous earth has in regard to the colouring particles; and that therefore the effects on human bones, and thoſe of warm-blooded animals, would be the ſame.

† Stirp. hiſt. pempt. 3. lib. i. cap. 28. p. 353.

‡ Colleg. pharmaceut. in Schröder, p. 645. Opp. i. Francof. 1696. fol.

§ Mem. de l'Acad. des ſciences, 1701. p. 273.

‖ Botanolog. lib. i. cap. 461. p. 664. Lond. 1710. fol.

what

what he relates is all taken from the treatiſe of Lemnius *De miraculis occultis naturæ;* and the latter therefore is the oldeſt writer that I at preſent can mention, as acquainted with this property. He was a phyſician in Zealand, where madder has been cultivated ſince the earlieſt ages, and where he had an opportunity of remarking it. He ſays that the bones of animals became red, as had been obſerved when the fleſh was dreſſed, by their eating only the leaves, and not the roots. In the firſt edition of the above work, printed in octavo, in the year 1559, which conſiſts of two books, this information will not be found; but it may be contained in the ſecond of 1564, which comprehends four books*. On the other hand, the work of Mizaldus, as far as I can find, was firſt printed in octavo, at Paris, in 1566; and conſiſted then of no more than nine centuries. The dedication which ſtands before my edition, printed in duo-

* Bayle, Diction. iii. p. 72. More editions are quoted in Haller's *Biblioth. botan.* i. p. 335, and *Biblioth. pract.* ii. p. 136. In my edition, Coloniæ Agrip. 1581, the following paſſage occurs, lib. iv. p. 423: Erythrodanum ſeu rubea oſſa pecudum ſandicino rubentique colore imbuit, ſi quando herbam virentem depaſtæ ſunt, intacta etiam radice, quæ rutila exiſtit; quod etiam in elixis decoctiſque ejus pecoris carnibus perſpici poteſt, et in ovis, quæ rubicundo colore radicis hujus decocto fucantur. That the green leaves contain alſo a red dye, and can really communicate a red colour, I have proved already in my *Experimenta emendandi rubiæ uſum tinctorium*, p. 65. It may be found in *Commentar. Societ. Gotting.* vol. viii.

decimo,

decimo, at Frankfort in 1559, is dated the ſame year. In that ſection where the author gives an account of the effects produced by madder, he refers ſeveral times to Lemnius *.

JUGGLERS.

UNDER this title I comprehend not only thoſe properly called jugglers, who, for the ſake of money, by quick and artful motions of their hands, bodies, and limbs, and by various preparations, delude the ſenſes in an agreeable manner, or practiſe an innocent deception on the ſpectators, ſo that they think they hear and ſee what they do not really hear and ſee, but alſo rope-dancers; people who place their bodies in poſitions, according to all appearance, dangerous; and thoſe who for pay exhibit animals taught to perform uncommon tricks, as well as automata, which by their con-

* Erythrodanum, vulgo rubia tinctorum dictum, oſſa pecudum rubenti et ſandycino colore imbuit, ſi dies aliquot illud depaſtæ ſint oves, etiam intacta radice, quæ rutila exiſtit. Res ea ſimiliter perſpici poteſt in carnibus hujus pecoris elixis et aſſatis. Nam rubicundæ apparent, ſicuti etiam ova in decocto ejus radicis elixata. *Centuriæ novem memorabilium, utilium ac jucundorum.* Cent. vii. p. 160. See *Halleri Biblioth. botan.* i. p. 327. *Biblioth. pract.* ii. p. 92.

cealed conſtruction ſeem to produce wonderful effects.

But is it worth while to enquire into the antiquity of all theſe arts, unprofitable to the public, which form the favourite amuſements of the populace? The ſelfiſh queſtion *cui bono*, which is often thrown out by way of reproach to men of letters, but oftenеſt to naturaliſts, and even to juriſts, when, in their reſearches, they advance beyond the beaten track, I might eaſily get rid of by civilly informing the queriſts to paſs over this article if they think they are not likely to derive benefit from it. I might alſo apologize for employing my time and labour on this ſubject, by uſing the words of a certain hiſtorian: *Frivola hæc fortaſſis cuipiam et nimis levia eſſe videantur, ſed curioſitas nihil recuſat.* I ſhall, however, adopt neither of theſe methods; as I flatter myſelf that this eſſay may afford as much amuſement as many that are read daily; and that therefore it may not only be excuſed but even juſtified.

Thoſe arts and employments which are moſt neceſſary in life were, undoubtedly, the earlieſt, and they have ſtill continued to be the moſt important; but when theſe were ſufficiently occupied, or carried on by as many perſons as could live by them, the reſt, who were excluded from them, conceived the idea of amuſing the former

when

when tired with their labour; that by theſe means they might obtain from them a part of the fruits of their induſtry. I requeſt my readers to reflect how many occupations have been deviſed for no other purpoſe. They will find that ſeveral of theſe have acquired a pre-eminence over the neceſſary or uſeful arts; and to the ſame claſs belong jugglers *.

All political writers tell us, as a fundamental principle of government, that population ought to be increaſed. This maxim, however, is juſt only under certain circumſtances: that is, when employment can be procured to a greater number of inhabitants than a country already poſſeſſes. Of beggars we have to maintain too many. All our trades and occupations are not only filled up with workmen, but overflow. Our farmers can

* Etudiez les progrés de la ſocieté, et vous verrez des agriculteurs dépouillés par des brigands; ces agriculteurs oppoſer à ces brigands une portion d'entr' eux, et voila des ſoldats. Tandis que les uns récoltent, et que les autres ſont ſentinelles, une poignée d'autres citoyens dit au laboureur et au ſoldat, Vous faites un métier pénible et laborieux. Si vous vouliez, vous ſoldats, nous defendre, vous laboureurs, nous nourir, nous vous déroberions une partie de votre fatigue par nos danſes et nos chanſons. Voila le trobadour et l'homme de lettres. Avec le tems, cet homme de lettres s'eſt ligué, tantôt avec le chef contre les peuples, et il a chanté la tyrannie; tantôt avec le peuple contre le tyran, et il a chanté la liberté. Dans l'un et l'autre cas, il eſt devenu un citoyen important. *Hiſt. philoſ. des établiſſem. et du commerce des Européens dans les Indes*, ii. p. 284.

employ

employ no more labourers; and our manufacturers no more hands than they have at preſent; our regiments are full; and in every employment there are more candidates and more ſupernumeraries than is conſiſtent with the good of the public. Muſt it not therefore give us pleaſure, when neceſſity invents new means of acquiring a livelihood, although they could be diſpenſed with? It is much better that thoſe who have learned no uſeful art; who have loſt their youth in the ſervice of others; or who are deſtitute, through any other cauſe, ſhould gain their bread by amuſing their fellow citizens, than that they ſhould either beg or ſteal.

Theſe arts are, indeed, not unprofitable, for they afford a comfortable ſubſiſtence to thoſe who practiſe them; but their gain is acquired by too little labour to be hoarded up; and, in general, theſe roving people ſpend on the ſpot the fruits of their ingenuity; which is an additional reaſon why their ſtay in a place ſhould be encouraged. I have, however, known ſome who ſaved ſo much from their earnings that, in their old age, they were enabled to enter into ſome buſineſs more certain as well as more profitable.

People of this deſcription will never want encouragement and ſupport while they exhibit with confidence any thing uncommon, and know how

to ſuit the nature of their amuſements to the taſte of the ſpectators. The greater part of mankind love deception ſo much, that they reward liberally thoſe who impoſe on their ſenſes, as is proved by the ready ſale of gilt articles, artificial gems, and a thouſand other things which are not in reality what they appear to be. I do not know whether Montagne is right in conſidering it as a ſign of the weakneſs of our judgment, that we take a pleaſure in beholding objects on account of their rarity, novelty, or the difficulty that attends them, though they may be ſubſervient to no uſeful purpoſe *. This appears to me to proceed from that innate curioſity which ſerves as a ſpur to incite us to enlarge our knowledge, and to engage in reſearches and undertakings that often lead to diſcoveries of greater importance.

Jugglers, indeed, ſeldom exhibit any thing that can appear wonderful to thoſe acquainted with natural philoſophy and mathematics; but theſe even often find ſatisfaction in ſeeing truths already known to them applied in a new manner; and they readily embrace every opportunity of having

* C'eſt un teſmoinage merveilleux de la foibleſſe de noſtre jugement, qu'il recommande les choſes par la rareté, ou nouvelleté, ou encore par la difficulté, ſi la bonté et utilité n'y ſont joinctes. *Eſſais*, i. 54. vol. i. p. 217. according to the London edition 1739.

them

them farther illuſtrated by experiments. Many, however, are too precipitate, and attempt to explain before they have ſufficiently examined, of which the golden tooth at the end of the ſixteenth century; the conjuring-rod at the end of the ſeventeenth; and the cheſs-player and ſpeaking-machine at the end of the preſent, may ſerve as inſtances. But it often happens, that what ignorant perſons firſt employ, merely as a ſhow, for amuſement or deception, is afterwards ennobled by being applied to a more important purpoſe. The machine with which a Savoyard, by means of ſhadows, amuſed children and the populace, was by Liberkühn converted into a ſolar microſcope; and, to give one example more, which may convince female readers, if I can hope for ſuch, the art of making ice in ſummer, or in a heated oven, enables gueſts, much to the credit of their hoſteſs, to cool the moſt expenſive diſhes. The Indian diſcovers precious ſtones, and the European, by poliſhing, gives them a luſtre.

But, if the arts of juggling ſerved no other end than to amuſe the moſt ignorant of our citizens, it is proper that they ſhould be encouraged for the ſake of thoſe who cannot enjoy the more expenſive deceptions of an opera. They anſwer other purpoſes, however, than that of merely amuſing: they convey inſtruction in the moſt acceptable manner, and ſerve as an agreeable antidote to ſuperſtition,

and

and to that popular belief in miracles, exorciſm, conjuration, ſorcery and witchcraft, from which our anceſtors ſuffered ſo ſeverely. Wherever the vulgar were aſtoniſhed at the effects of ſhadows, electricity, mirrors, and the magnet, intereſted perſons endeavoured by theſe to frighten them; and thus miſapplied the powers of nature to promote their own advantage. The pontiffs and their clergy ought, undoubtedly, to be deteſted for diſcouraging experimental philoſophy. That ſcience they conſidered as a formidable enemy; and they thought they gained no ſmall advantage when they induced the houſe of Medici, by granting it the cardinalſhip, to ſuppreſs the *Academy del Cimento*. When Gaſner exhibited his deceptions, ſome one propoſed to him to try his art at Berlin or Gottingen, and to drive out there if it were only the ſmalleſt of all the devils; but theſe cities were not theatres where he was likely to ſucceed, and he never ventured to appear in them *. It is, however, better that the populace, if they will abſolutely pay for being deceived, ſhould be expoſed to a momentary deception from jugglers than to a continual deception from prieſts. As the former are not covered with the ſacred cloak of religion,

* The juggler, mentioned in Xenophon, requeſted the Gods to allow him to remain only in places where there was much money, and abundance of ſimpletons. "Οπου αν η, διδοναι κερπου μεν αφθονιαν, φρενων δε αφοριαν.

their

their deceptions are more eaſily ſeen through and detected; and they conſequently ſoon ceaſe to be hurtful. So late as the year 1601, a horſe, which had been taught to perform a number of tricks, was tried, as poſſeſſed by the devil, and condemned to be burnt *. At preſent ſuch horſes are ſo often exhibited publicly in the heretical countries of Europe, that the Spaniſh inquiſition, perhaps, will ſoon be aſhamed of conſidering ſuch a proof of the docility of theſe animals, and of the patient dexterity of their teachers, as the work of the devil, as they did in the beginning of this century. Thoſe who, like me, wiſh to view the art of the juggler in this light, will, I hope, forgive me for introducing theſe obſervations, and allow me to continue them while I enquire into the antiquity of this employment; eſpecially as I ſhall endeavour by theſe means to illuſtrate more fully my ſubject.

Had that book which Celſus wrote againſt the *Magi* been preſerved, we ſhould have been much

* Le Siècle de Louis XIV. Berlin 1751. 12mo. i. p. 44. This horſe was ſeen in the abovementioned year by Caſaubon, to whom the owner, an Engliſhman, diſcovered the whole art by which he had been trained. See *Caſauboniana*, p. 56. We are aſſured by Jablonſki, in his *Lexicon der künſte und wiſſenſchaften*, p. 547, that he was condemned to the flames at Liſbon. In the year 1739, a juggler, in Poland, was tortured till he confeſſed that he was a ſorcerer, and without farther proof he was hanged. The whole account of this circumſtance may be found in the *Schleſiſchen gelehrten neuigkeiten* for the year 1739.

better acquainted with the art of the ancient conjurors or jugglers. This Celſus, without doubt, is the ſame author whoſe virulent attack againſt the Chriſtians was refuted by Origen; and we have, therefore, greater cauſe to regret that a work on the above ſubject, by ſo learned and acute a philoſopher, ſhould have been loſt. He is mentioned with reſpect by Lucian, and even by Origen; and the former derived from him the account which he gives of Alexander the impoſtor *. More ancient authors alſo wrote upon the ſame ſubject. Some of them are mentioned by Diogenes Laertius in his preface; and Suidas quotes the Magicon of Antiſthenes, though neither of theſe ſpeaks of Celſus; but of all thoſe writings none are now extant.

The deception of breathing out flames, which at preſent excites, in a particular manner, the aſtoniſhment of the ignorant, is very ancient. When the ſlaves in Sicily, about a century and a half before our æra, made a formidable inſurrection, and avenged themſelves in a cruel manner for the ſeverities which they had ſuffered, there was amongſt them a Syrian named Eunus †, a man of great

* See Luciani Opera, ed. Bipont. v. p. 388 and 407. *Spencerî Annotat. in libr. i. Origenis contra Celſum*, p. 3. *Fabricii Biblioth. Græca*, vol. ii. p. 809.

† Syrus quidam nomine Eunus fanatico furore ſimulato, dum Syriæ Deæ comas jactat, ad libertatem et arma ſervos quaſi numinum

great craft and courage, who, having paſſed through many ſcenes of life, had become acquainted with a variety of arts. He pretended to have immediate communication with the gods; was the oracle and leader of his fellow-ſlaves; and, as is uſual on ſuch occaſions, confirmed his divine miſſion by miracles. When, heated by enthuſiaſm, he was deſirous of inſpiring his followers with courage, he breathed flames or ſparks among them from his mouth while he was addreſſing them. We are told by hiſtorians, that for this purpoſe he pierced a nut-ſhell at both ends, and, having filled it with ſome burning ſubſtance, put it into his mouth and breathed through it. This deception, at preſent, is performed much better. The juggler rolls together ſome flax or hemp, ſo as to form a ball about the ſize of a walnut; ſets it on fire; and ſuffers it to burn till it is nearly conſumed; he then rolls round it, while burning, ſome more flax; and by theſe

num imperio concitavit; idque ut divinitus fieri probaret, in ore abdita nuce, quam ſulphure et igne ſtipaverat, leniter inſpirans, flammam inter verba fundebat. *Florus*, iii. 19, 4. Τελευταιον δια τινος μηχανης πυρ, μετα τινος ενθουσιασμου, και φλογα δια του ϛοματος ηφιει, και ουτω τα μελλοντα απεφοιβαζεν. εις γαρ καρυον η τι τοιουτο τετρημενον εξ ἑκατερου μερους ενετιθει πυρ, και την συνεχειν αυτο δυναμενον ὑλην. ειτα εντιθεις τω ϛοματι, και προσπνεων, ποτε μεν σπινθηρας, ποτε δε φλογα εξεκαεν. Diodor. Sic. *ecl.* 34. p. 526. Sulphur, which is mentioned by Florus, would hardly be fit for the purpoſe. Compare *Alexand. ab Alex. Gen. dies*, ii. 11. p. 345. Sulphur, however, is uſed for the like end in the Eaſt, even at preſent. See *Shaws Reiſen*, p. 214.

means the fire may be retained in it for a long time. When he wiſhes to exhibit, he ſlips the ball unperceived into his mouth and breathes through it; which again revives the fire, ſo that a number of weak ſparks proceed from it; and the performer ſuſtains no hurt, provided he inſpire the air not through the mouth but the noſtrils *.

By this art the rabbi Bar-Cocheba, in the reign of the emperor Hadrian, made the credulous Jews believe that he was the hoped-for Meſſias †; and two centuries after, the emperor Conſtantius was thrown into great terror, when Valentinian informed him that he had ſeen one of the body guards breathing out fire and flames in the evening ‡.

For deceptions with fire the ancients employed

* Directions for performing this trick may be found in various works, ſuch as Joh. Wallbergen's *Sammlung natürlicher zauberkünſte*. Stuttgard 1754, 8vo. p. 25. and *Natürliches zauberbuch*. Nurnberg, 1740, 8vo. p. 110.

† Tu videlicet flammeus, immo fulmineus, qui in loquendo fulminas, atque ut ille Barchochebas auctor ſeditionis Judaicæ. ſtipulam in ore ſuccenſam anhelitu ventilabat, ut flammas evomere videretur. *Hieronymi Apolog.* ii. *adverſus Ruffinum.* See *Bayle's Diction.* i. p. 450. art. Barchochebas.

‡ Valentinianum aiunt vidiſſe quendam ex iis qui ſilentiarii vocantur flammam ignis ore evomentem, πυρος φλογα του στοματος αφιεντα, vidiſſe id vero circa veſperam, quando poſt cibum ſomnum capere ſolemus, et hæc quidem Conſtantio ſignificaſſe, qui nuncio hoc in ſuſpicionem metumque verſus eſt. *Philostorgii Hiſt. eccleſ.* vii. 7. p. 93.

alſo

alſo naphtha, a liquid mineral oil, which kindles when it only approaches a flame. Galen informs us, that a perſon excited great aſtoniſhment by extinguiſhing a candle and again lighting it, without any other proceſs than holding it immediately againſt a wall or a ſtone. The whole ſecret of this conſiſted in having previouſly rubbed over the wall or ſtone with ſulphur *. But as the author, a few lines before, ſpeaks of a mixture of ſulphur and naphtha †, we have reaſon to think that he alludes to the ſame here. Plutarch ‡ relates how Alexander the Great was aſtoniſhed and delighted with the ſecret effects of naphtha, which were exhibited to him at Ecbatana. The ſame author, as well as Pliny, Galen, and others, has already remarked, that the ſubſtance with which Medea deſtroyed Creuſa, the daughter of Creon, was nothing elſe than this fine oil ‖. She ſent to the unfortunate princeſs a dreſs beſmeared with it, which burſt into flames as ſoon as ſhe approached the

* Jam illud ceu rem mirandam quidam oſtentavit ; extinxit lucernam, ac rurſus muro admovens accendit. Alter lapidi eam admovit. Fuerant autem tum murus, tum lapis ſulfure contacti, quod ubi deprehenſum eſt, deſiit mirum videri, quod oſtentabant. Ἐπεθειωτο δε αρα και ὁ τοιχος και ὁ λιθος. Galen De temperamentis, iii. 2. p. 44.

† Δια τε θειου και της ὑγρας ασφαλτου.

‡ Vita Alexandri, p. 687.

‖ Galen. l. c.

fire of the altar. The blood of Neſſus, in which the dreſs of Hercules, which took fire likewiſe, had been dipped, was undoubtedly naphtha alſo *; and this oil muſt have been always employed when offerings caught fire in an imperceptible manner †. In all periods of the world prieſts have acted as jugglers to ſimple and ignorant people.

In modern times, perſons who could walk over burning coals or red-hot iron, or who could hold them in their hands and their teeth, have often excited wonder. In the end of the laſt century, an Engliſhman, named Richardſon, who, as we are aſſured, could chew burning coals; pour melted lead upon his tongue; ſwallow melted glaſs, &c. rendered himſelf very famous by theſe extraordinary feats ‡. Laying aſide the deception practiſed on the ſpectators, the whole of this ſecret conſiſts in rendering the ſkin of the ſoles of the feet and hands ſo callous and inſenſible, that the nerves under them are ſecured from all hurt, in the ſame manner as by ſhoes and gloves. Such

* Ovid. Metamorph. lib. ix. 160.

† Inſtances may be found collected in *Huetii Alnetanæ queſtion.* lib. ii. cap. 12, 21, p. 171; and in *Bayle's Dictionary*, art. Egnatia, p. 344.

‡ *Journal des ſçavans*, 1667, p. 54, 222; and 1680, p. 292. *Deſlandes, Mémoires de phyſique*, ii. and *Bremenſcher Magazin*, i. p. 665. See alſo *Buſbequii Omnia.* Baſil. 1740, 8vo. p. 314.

calloſity

callosity will be produced if the skin is continually compressed, singed, pricked, or injured in any other manner. Thus do the fingers of the industrious sempstress become horny by being frequently pricked; and the case is the same with the hands of fire-workers, and the feet of those who walk bare-footed over scorching sand.

In the month of September, 1765, when I visited the copper-works at Awestad, one of the workmen, for a little drink-money, took some of the melted copper in his hand, and after shewing it to us, threw it against a wall *. He then squeezed the fingers of his horny hand close to each other; put it a few minutes under his armpit, to make it sweat, as he said; and, taking it again out, drew it over a ladle filled with melted copper, some of which he skimmed off, and moved his hand backwards and forwards, very quickly, by way of ostentation. While I was viewing this performance, I remarked a smell like that of singed horn or leather, though his hand was not burnt. The workmen at the Swedish melting-houses shewed the same thing to some travellers in the last century; for Regnard saw it in 1681, at the copper works in Lapland †. It is highly probable

* The same thing was performed when Mr. Schreber was there, in 1760. See his father's *Neue Sammlung*, i. p. 113.

† Algem. histor. der reisen, xvii. p. 308.

that people who hold in their hands red hot iron, or who walk upon it, as I ſaw done at Amſterdam, but at a diſtance, make their ſkin callous before, in the like manner. This may be accompliſhed by frequent moiſtening it with ſpirit of vitriol; according to ſome the juice of certain plants will produce the ſame effect; and we are aſſured by others that the ſkin muſt be very frequently rubbed, for a long time, with oil, by which means, indeed, leather alſo will become horny *.

Of this art traces may be found alſo in the works of the ancients. A feſtival was held annually on Mount Soracte, in Etruria, at which the Hirpi, who lived not far from Rome, jumped through burning coals; and on this account they were indulged with peculiar privileges by the Roman ſenate †. Women alſo, we are told, were accuſtomed to walk over burning coals at Caſtabala, in Cappadocia, near the temple dedicated to Diana ‡. Servius remarks, from a work of Varro now loſt, that the Hirpi truſted not ſo much to their own ſanctity as to the care which they

* Haller, Elementa phyſiolog. v. p. 16.

† Plin. vii. 11, p. 372. *Virg. Æn.* xi. 785. *Silius Ital.* v. 175. Strabo, v. p. 372. ed. Almel. The latter calls this feſtival θαυμασην ἱεροποιίαν. Solin. cap. ii. 26.

‡ Strabo, xii. p. 811.

had

had taken to prepare their feet for that operation*.

I am not acquainted with every thing that concerns the trial by ordeal, when perſons accuſed were obliged to prove their innocence by holding in their hands red hot iron; but I am almoſt convinced that this alſo was a juggling trick of the popes, which they employed as might beſt ſuit their views. It is well known that this mode of exculpation was allowed only to weak perſons, who were unfit to wield arms, and particularly to monks and eccleſiaſtics, to whom, for the ſake of their ſecurity, that by ſingle combat was forbidden. The trial itſelf took place in the church entirely under the inſpection of the clergy; maſs was celebrated at the ſame time; the defendant and the iron were conſecrated by being ſprinkled with holy water; the clergy made the iron hot themſelves; and they uſed all theſe preparatives, as jugglers do many motions, only to divert the attention of the ſpectators. It was neceſſary that the accuſed perſons ſhould remain at leaſt three days and three nights under their immediate care, and continue as long after. They covered their

* Virgil. quidem dixit; freti pietate, ſed Varro, ubique expugnator religionis, ait, cum quoddam medicamentum deſcriberet: et ut ſolent Hirpini, qui ambulaturi per ignem medicamento plantas tingunt.

hands

hands both before and after the proof; ſealed and unſealed the covering: the former, as they pretended, to prevent the hands from being prepared any how by art; and the latter to ſee if they were burnt *.

Some artificial preparation was therefore known, elſe no precautions would have been neceſſary. It is highly probable that, during the three firſt days, the preventative was applied to thoſe perſons whom they wiſhed to appear innocent; and that the three days after the trial were requiſite to let the hands reſume their natural ſtate. The ſacred ſealing ſecured them from the examination of preſumptuous unbelievers: for to determine whether the hands were burnt, the three laſt days were certainly not wanted. When the ordeal was aboliſhed, and this art rendered uſeleſs, the clergy no longer kept it a ſecret. In the thirteenth century an account of it was publiſhed by Albertus Magnus, a Dominican monk †. If his receipt be

* See Grupen's learned Diſſertation in the *Hannoverſchen gelehrten anzeigen*, 1751, p. 679.

† In his work *De mirabilibus mundi*, at the end of his book *De ſecretis mulierum*, Amſtelod. 1702, 12mo. p. 100. Experimentum mirabile quod facit hominem ire in ignem ſine læſione, vel portare ignem vel ferrum ignitum ſine læſione in manu. Recipe ſuccum biſmalvæ, et albumen ovi, et ſemen pſylli et calcem, et pulveriza, et confice cum illo albumine ovi ſuccum raphani; commiſce; ex hac confectione illineas corpus tuum vel manum, et dimitte ſiccari, et poſtea iterum illineas, et poſt hoc poteris audacter ſuſtinere ignem ſine nocumento.

genuine,

genuine, it ſeems to have conſiſted rather in covering the hands with a kind of paſte than in hardening them. The ſap of the *althæa* (marſh-mallow), the ſlimy ſeeds of the flea-bane, which is ſtill uſed for ſtiffening by the hat-makers and ſilk-weavers, together with the white of an egg, were employed to make the paſte adhere; and by theſe means the hands were as ſafe as if they had been ſecured by gloves. The uſe of this juggling trick is very old, and may be traced back to a pagan origin. In the Antigone of Sophocles, the guards placed over the body of Polynices, which had been buried contrary to the orders of Creon, offered, in order to prove their innocence, to ſubmit to any trial: "We will," ſaid they, "take up red-hot iron in our hands, or walk through fire *."

The exhibition of balls and cups, which is often mentioned in the works of the ancients, as the moſt common art of jugglers, is alſo of great antiquity. It conſiſts in conveying ſpeedily, and with great dexterity, while the performer endeavours by various motions and cant phraſes to divert the attention of the ſimple ſpectators from

* Ημεν δ' ετοιμοι και μυδρους αιρειν χεροιν,
Και πυρ διερπειν, και θεους ὁρκωμοτειν
Το μητε δρασαι, μη τε τω ξυνειδεναι
Το πραγμα βουλευσαντι, μητ' ειργασμενω.
Antigone, 270, p. 248, ed. Cantabrigiæ 1665. 8vo.

obſerving his movements too narrowly, ſeveral light balls, according to the pleaſure of any perſon in company, under one or more cups; removing them ſometimes from the whole; and conveying them again back in an imperceptible manner. In general, three leaden cups are uſed, and as many balls of cork; and to prevent all diſcovery by their ſlipping from the thumbs of the juggler, or making a noiſe, as he muſt lay hold of them with much quickneſs *, the table before which he ſits is covered with a cloth †.

Theſe ſmall balls were by the ancients called *calculi;* and the cups *acetabula*, or *paropſides* ‡. Caſaubon || has already quoted moſt of thoſe paſſages in ancient authors which relate to this ſubject; and they have been repeated by Bulenger §; but neither of theſe writers makes mention of the fulleſt and cleareſt deſcription given in the letters

* Κλεπτειν, which word was often uſed when any thing was done ſpeedily and unperceived. Xenophon ſays, κλεπτειν ορη, montes clam hoſtibus occupare.

† Natürliches zauberbuch, p. 3.

‡ Λιθιδια or ψηφοι, calculi; παροψιδες, acetabula, or paropſides. The performer was called ψηφοκλεπτης, or ψηφοπαικτης, and ψηφολογος; and the exhibition ψηφοπαιξια.

|| Animadverſ. in Athenæi Deip. lib. i. 15, p. 46.

§ De theatro, lib. i. 40, in *Grævii Theſaurus antiquit. Roman.* ix. p. 902.

of

of Alciphron *. We have there an account of a countryman who came to town, and was conducted by a merchant to the theatre, where he ſaw, with great aſtoniſhment, the exhibition of cups and balls. "Such an animal," ſays he, "as the performer I would not wiſh to have near me in the country; for, in his hands, my property would

* Lib. iii. epiſt. 20. ed. Bergler. p. 321. Unum autem ut vidi, hiſco jam et prope ſum mutus factus. Quidam enim in medios progreſſus, collocata menſa tripode, tres exiguas apponebat patellas; deinde ſub iſtis occultabat parvos quoſdam candidos et rotundos lapillos, quales nos in ripis torrentium reperimus; hos modo ſingulatim ſub una quavis occultabat patella; modo, neſcio qua ratione, ſub una aliqua omnes oſtentabat: modo, ut ſub patellis diſparerent efficiebat, et in ore oſtendebat. Deinde cum deglutiiſſet (adductis in medium qui prope adſtabant) alium ex nare, alium ex aure, alium ex capite depromebat; deinde iterum ſublatos ex oculis hominum removebat. Maxime clancularius ille homo eſt. - - - - Ne mihi exiſtat ruri talis beſtia, non enim deprehendetur a quoquam, omniaque domi furripiens, evanida quæ ruri habeo faciet. *Seneca, epiſt.* 45: Sic iſta ſine noxa decipiunt, quomodo præſtigiatorum acetabula et calculi, in quibus fallacia ipſa delectat. Effice, ut quomodo fiat intelligam, perdidi uſum. *Sextus Empiric.* Sicuti præſtigiatores ſpectantium oculos agilitate manuum ſuffurantur ac illudunt, ita et rhetores. - - - *Gregor. Nazian. in Athanaſ.* Idem erat calculis ludere decipientibus occulos celeritate tranſpoſitionis, - - - ταῦτον ην ψηφοις τε παιζειν την οψιν κλεπτουσαις τῳ ταχει της μεταθεσεως. - Compare *Suidas*, *Pollux* and *Athenæi Deipn.* 4. It is probable that Quintilian alludes to this art in his *Inſtitut.* x. 7, 11. Quo conſtant miracula illa in ſcenis pilariorum ac ventilatorum, ut ea, quæ emiſerint, ultro venire in manus credas, et qua jubentur decurrere.

ſoon

ſoon diſappear." The art of oratory, becauſe it deceives the auditors, is frequently compared to that of balls and cups. From the Latin word *gabata*, mentioned by Martial, together with *paropſides*, the French have made *gobelets*; and hence their common expreſſions *jouer des gobelets*, and *joueur des gobelets*, which they uſe when ſpeaking of jugglers.

In all ages of the world there have been men who excited great wonder by extraordinary ſtrength. Inſtances of this have been already collected; but they do not belong to my preſent ſubject *. I can, however, prove that, above fifteen hundred years ago, there were people who, by applying a knowledge of the mechanical powers to their bodies, performed feats which aſtoniſhed every ignorant ſpectator; though it is certain that any ſound man of common ſtrength could perform the ſame by employing the like means. Of theſe one may ſay with Celſus: *Neque Hercule ſcientiam præcipuam habent hi, ſed audaciam uſu ipſo confirmatam.*

About the beginning of the preſent century ſuch a ſtrong man, or Sampſon, as he called him-

* Plin. vii. 20, p. 385. *Martial.* v. 12. *Suidas*, ſpeaking of Theogenes Thaſius. *Haller*, *Elementa phyſiolog.* iv. p. 486; of the edition in quarto.

ſelf,

ſelf, a native of Germany, travelled over almoſt all Europe; and his pretended art has been mentioned by ſo many writers, that we may conclude it had not been often exhibited before; and that it was then conſidered as new *. His name was John Charles von Eckeberg; he was born at Harzgerode in Anhalt; and, at that time, was thirty-three years of age. When he fixed himſelf between a couple of poſts, on any level place, two or more horſes were not able to draw him from his poſition; he could break ropes aſunder, and lift a man up on his knee while he lay extended on the ground. But what excited the greateſt aſtoniſhment was, that he ſuffered large ſtones to be broke on his breaſt with a hammer, or a ſmith to forge iron on an anvil placed above it.

This laſt feat was exhibited even in the third century, by Firmus or Firmius, who, in the time of Aurelian, endeavoured to make himſelf emperor in Egypt. He was a native of Seleucia in Syria; eſpouſed the cauſe of Zenobia, the celebrated queen of Palmyra; and was at length executed publicly by order of the emperor Aurelian †. It is of this

* Breſlauer Sammlung von natur- und kunſt-geſchichten, i. p. 82; iii. p. 882; v. p. 1511; xxv. p. 333; and xxxii. p. 320. *Hauber*, *Bibliotheca magica*, part xxi. p. 577, where the art is illuſtrated with figures.

† Algemeine welthiſtorie, xiii. p. 621.

Firmus,

Firmus, and not of another, who a century after was overcome in Africa by the father of the emperor Theodoſius *, that Vopiſcus ſpeaks where he relates that he could ſuffer iron to be forged on an anvil placed on his breaſt. For this purpoſe he lay on his back; but he put himſelf in ſuch a poſition, by reſting with his feet and ſhoulders againſt ſome ſupport, that his whole body formed an arch; ſo that he ſeemed rather to be ſuſpended than to lie at full length †. This art, which is explained and illuſtrated by Deſaguliers ‡, and profeſſor Kuhn ||, of Dantzic, has now be-

* Algemeine welthiſtorie, xiv. p. 269.

† Vopiſcus, Vita Firmi: Incudem ſuperpoſitam pectori conſtanter aliis tundentibus pertulit, cum ipſe reclivus ac reſupinus et curvatus in manus penderet potius quam jaceret. The whole paſſage will be better underſtood, when one ſees the figure in Deſaguliers, tab. xix. fig. 5, only that *in manus* occaſions ſome difficulty. I conjecture that Vopiſcus wrote *in arcum*, as Virgil *Georg.* ii. 448 ſays: *taxi curvantur in arcus*. Deſaguliers, p. 266, deſcribes the poſition thus: The pretended Sampſon puts his ſhoulders (not his head, as he uſed to give out,) upon one chair, and his heels upon another (the chairs being made faſt), and ſupports one or two men ſtanding on his belly, raiſing them up and down as he breathes, making with his backbone, thighs and legs, an arch whoſe abutments are the chairs. Seneca, in his treatiſe *De Ira*, ii. 12, ſays of theſe people: Didicerunt ingentia vixque humanis toleranda viribus onera portare.

‡ A courſe of experimental philoſophy, London 1745. 4to. i. p. 266 and 272.

|| Verſuche und abhandl. der Naturforch. Geſelſch. in Dantzig, i. p. 15.

come

come ſo common that it is often exhibited without occaſioning much ſurpriſe.

In the works of the ancients, rope-dancers are frequently mentioned. The paſſages where they occur have been collected by various authors, though never completely; and I am inclined to think that thoſe who have ſeen many performers of this kind would be able to clear up ſome that are obſcure. I have ſeen many myſelf; but I have forgot the greater part of what I obſerved; and there are other reaſons alſo which prevent me from undertaking that taſk: I dread the reproach of *multum agendo nihil agis*. That I may not, however, paſs over this ſubject entirely, I ſhall preſent the reader with what follows *. We meet with various appellations given to rope-dancers, which do not, as ſome have imagined, point out different kinds, but allude only to new-invented arts, leaps, or dexterities, which, while recommended by novelty, were much wondered at,

* A great many of theſe paſſages of the ancients have been collected by Boulenger, in his work *De theatro*, i. cap. 41; but without order and without any explanation. Something more is done by Des Camps in *Diſſertat. ſur une medaille de Caracalle, repréſentant des danſeurs de corde*, which may be found in *Recherches curieuſes d'antiquité, par Spon*. A Lyon 1683. 4to. p. 407. An extract from it is inſerted in *Journ. des ſav.* 1677, p. 309. See alſo *Hier. Mercurialis De arte gymnaſt.* and *Fabricii Biblioth. antiquar.* p. 995.

though they were afterwards imitated by all. To these belong the *ſchænobatæ*, *oribatæ*, *neurobatæ*, *petaminarii*, *funambuli*, &c. Some of the ancient rope-dancers ſeem to have uſed a balancing pole, or, at leaſt, to have had weights in their hands to preſerve an equipoiſe *. It is certain, alſo, that rope-dancers were not wanting in the middle ages. In the year 1237 they were very common in Italy †; and in 1393 there were ſome of them at Augſburg, who exhibited their dexterity on the rope, and received from each ſpectator three German halfpence ‡.

* An epigram, aſcribed to Petronius, which is not to be found in moſt editions of that author, and which I ſhall here tranſcribe from that of Hadrianides, p. 542, belongs to this ſubject:

Stupea ſuppoſitis tenduntur vincula lignis,
Quæ ſido aſcendit docta juventa gradu.
Quæ ſuper aërius prætendit crura viator,
Vixque avibus facili tramite currit homo.
Brachia diſtendens greſſum per inane gubernat,
Ne lapſa e gracili planta rudente cadat.
Dædalus adſtruitur terras mutaſſe volatu,
Ex medium pennis profecuiſſe diem.
Præſenti exemplo firmatur fabula mendax,
Ecce hominis curſum funis et aura ferunt.

A paſſage of Nazianzenus, in his *Apologia*, alludes to the ſame art alſo: Ut iis, qui in ligno alto et ſuſpenſo ambulant, non tutum eſt in hanc vel illam partem propendere vel leviter, ſecuritatem autem affert iis æquale libramentum. Ἀσφαλὲς δὲ αὐτοῖς ἡ ἰσορροπία καθίσταται.

† Muratori Antiquit. Ital. med. ævi, ii. p. 846.

‡ Von Stetten, Kunſtgeſchichte von Augſburg, ii. p. 177.

To

To place men upon the ſhoulders of each other in ſuch a manner that every row conſiſts of a man fewer, till they form a pyramid ending in a ſingle perſon, upon whoſe head a boy often ſtands with his feet upwards, is likewiſe an ancient piece of dexterity. This exhibition is varied many ways; and, on that account, it is difficult to form even conjectures reſpecting it, eſpecially as the deſcription given of it by a Roman poet is very unintelligible *.

I am, however, ſtill leſs acquainted with an art in which hoops and wheels were employed by the *petauriſtæ*, who excited great aſtoniſhment among the populace. The firſt part of the art may have conſiſted in nothing more than the varied contortions and tumbling which we ſtill ſee practiſed by children trained for that purpoſe. Cilano explains a well-known paſſage of Manilius, as if the performers had darted through ſuſpended iron hoops, made often red hot. Of this I entertain leſs doubt than how we ought to underſtand the *corpora jactata petauro* of Juvenal †; and the *corpora*

* Claudian. de Mallii conſul. 320. In Cilano's *Römiſchen alterthümer*, ii. p. 573. fig. 8. there is a repreſentation like what I have often ſeen exhibited. But the moſt dangerous and the moſt curious is that of which an engraving is given in *Splendor urbis Venetiarum*, to be found in *Theſaurus antiquit. Italiæ*, v. 3. p. 374.

† Sat. xiv. 265.

valido excuſſa petauro of Manilius*, which many have attempted to explain already. At any rate this wheel was different from that upon which a female dancer, as mentioned by Xenophon, wrote and read while it turned round with great velocity †.

* Lib. v. 433.

† Sympoſium, p. 655, edition of Baſle, 1555. fol. Εισεφερετο τη ορχηστριδι τροχος των κεραμεικων εφ'ου εμελλε θαυμασιουργησειν. In the old edition of J. Ribittus, this paſſage is thus tranſlated: Allata eſt ſaltatrici orbis ſaltatorius, in quo admiranda erat editura. The firſt queſtion that ariſes is, what was τροχος των κεραμεικων. The laſt word alluded to a place at Athens where wreſtling was exhibited every year; and on that account Ariſtophanes uſes the expreſſion πληγαι κεραμεικαι. This, however, affords no explanation. Boulenger, who quotes the ſame paſſage, tranſlates it in the following manner: Illata eſt ſaltatrici figularis rota, per quam ſe trajiceret, et miracula patraret. He means here therefore a potter's wheel, the invention of Anacharſis, but that was always called κεραμικος τροχος and not τροχος των κεραμεικων. But even allowing that a potter's wheel is meant, it is wrong to add *per quam ſe trajiceret*; for the potter's wheel is not like a hoop, but like a plate or diſh; and when turned round revolves not vertically but horizontally. Beſides, how the performer could write or read on a wheel that ſhe jumped through, he has not thought proper to explain. Τοτε επι του τροχου αμα περιδινουμενου γραφειν τε, και αναγινωσκειν, θαυμα εστι. Scribere et legere in rota dum verſatur, mirabile quiddam eſt. If a potter's wheel be meant, I conſider it as certainly poſſible for a perſon to ſtand upon it whilſt it revolves with the greateſt velocity, and even to read or write; but it would be neceſſary to lift up the legs, in turn, with the utmoſt quickneſs.

The

The art of exhibiting various feats of horſemanſhip, which has been practiſed ſo much in modern times, ſeems to have come firſt from the Eaſt. At any rate, thoſe performers in that way who, in the thirteenth century, were at the Byzantine court, and who travelled all over Europe, came from Egypt. They could ſtand on the horſes when at a gallop; mount and diſmount while on full ſpeed at the chace; tumble on horſeback, and do many other things equally extraordinary *. At the end of the ſixteenth century, an Italian, who had learned this art while a ſlave in Turkey, went about exhibiting his dexterity in various parts of

* Nicephorus Gregor. viii. 10. p. 215. This company of rope-dancers came from Egypt. They travelled through the greater part of Aſia, and all Europe as far as the extremity of Spain. At Conſtantinople they extended the ropes, on which they firſt exhibited their art, between the maſts of ſhips. As the above book is not to be met with in every library, I would have inſerted here the whole account, had it not been tranſcribed by Cilano, ii. p. 570. One is almoſt induced to believe that ſtupid ſuperſtition did not then prevail ſo much in Europe as at the beginning of the preſent century. The hiſtorian ſays, that the company at firſt conſiſted of forty perſons; but that the half of them were caſt away on their paſſage to Conſtantinople. He does not, however, tell us that they or their horſes were any where burnt as conjurors or poſſeſſed with the devil. On the contrary, he adds: Quæ ab illis agebantur, erant illa quidem monſtroſa et ſane mirabilia; non tamen quicquam cum diabolicis præſtigiis commune habebant; ſed erant ſtudia quædam dextri ingenii, longo tempore in hujuſmodi rebus verſati. Επιτηδευματα φυσεως δεξιας, εγγυμναζομενης εκ πλειονος ες εργων τοιουτων ασκησιν.

Europe*. Montagne ſaw him at Rome in 1581 †; and the year following he was at Paris ‡. Some of theſe feats were performed by the ancient *deſultores* §.

Whether the ancients taught horſes, dogs, birds, and other animals, to perform various tricks which are frequently exhibited at preſent for money, I do not know; but it is certain that what they made the elephant, which, undoubtedly, is the moſt ſagacious and tractable of all animals, perform, exceeds every thing yet known of the kind. Without repeating what has been ſo often related, I ſhall only mention the elephant which walked upon a rope backwards and forwards, as well as up and down; and which Galba firſt cauſed to be ſhewn to the Roman people. After this, ſo much confidence was placed in the dexterity of the animal, that a perſon ſat on an elephant's back while he walked acroſs the theatre upon a rope extended

* Anthologia Romana, iii. p. 113.

† See the German tranſlation of his Travels, ii. p. 238.

‡ Journal du regne de Henry III. p. 57. It may be found in *Recueil de diverſes pièces ſervant à l'hiſt. de Henry* III. Cologne 1666. 12mo.

§ The playing at ball on horſeback mentioned by Meurſius in his *Gloſſarium Græco-barbarum*, Lugd. Bat. 1614. 4to. p. 556, from the works of Achmet, does not belong to this ſubject.

from

from the one ſide to the other. Lipſius, who has collected the teſtimonies, thinks they are ſo ſtrong that they cannot be doubted *.

The training of horſes to obey a private ſignal, imperceptible to the moſt attentive ſpectator, and to perform actions which appear, to thoſe unacquainted with the art, to diſplay rational faculties, I have never found mentioned in the works of the ancients. That the Sybarites, however, taught their horſes to dance to the ſound of muſic, is aſſerted by a variety of authors †. In the ſixteenth century, dogs trained in the like manner excited great wonder ‡.

In

* Epiſtolarum ſelectarum centuria. Antverpiæ 1605. 4to. i. epiſt. 50. p. 59. *Plin.* viii. 1 and 3. *Seneca, epiſt.* 86. *Suetonii Vit. Galbæ. Dio Caſſius.* A great many alſo may be found collected in *Hartenfels Elephantographia*, Erfordiæ, 1715. 4to. It appears that in the thirteenth century ſome ventured to ride a horſe upon a rope. In the Chronicle *Alberichi monachi Trium-Fontium*, inſerted by Leibnitz in *Acceſſiones hiſtoricæ*, vol. ii. we read the following paſſage, where a deſcription is given of the ſolemnities at the wedding of Robert, brother to the king of France, in the year 1237: Miniſtelli in ſpectaculo vanitatis multa fecerunt, ſicut ille, qui in equo ſuper chordam in aere equitavit.

[Several inſtances of the dexterity of the elephant may be found in *Lipſii Laus Elephantis*, inſerted in *Diſſertat. Ludicrarum et amœnitatum ſcriptores varii*, Lugd. Bat. 1638. Trans.]

† Ælian Hiſt. animal. xvi. 23. vi. 10. *Athenæus*, lib. xii. *Plinius. Euſtathius* ad *Dionyſ. de ſitu orbis*, 372. p. 52. edit. Stephani, 1577. 4to.

‡ One inſtance may be found in *Theophanis Chronographia*,

In the year 1766, an Engliſhman, named Wildman, made himſelf much known by taming or training bees, in ſuch a manner that they not only followed him wherever he went, but ſettled even on his face and hands without ſtinging him, and ſeemed as if obedient to his orders *. Some years after, a perſon who practiſed the like art, travelled about through Germany, and gave himſelf out to be Wildman; but Mr. Riem proved that he was not Wildman, and publiſhed the ſecret by which he acquired ſo much power over theſe inſects †. I

which was printed at Paris 1655, fol. and at Venice in 1729. It occurred in the ſeventeenth year of the reign of Juſtinian, or 543: Eodem anno planus ac circulator quidam, Andreas nomine, ex Italicis partibus adfuit, ſulvum et orbum lumine circumducens canem, qui ab eo juſſus, et ad ejus nutum, mira edebat ſpectacula. Is ſiquidem in forum, magna populi circumſtante caterva, prodiens annulos aureos, argenteos et ferreos, clam cane, a ſpectatoribus depromebat, eoſque in ſolo depoſitos aggeſta terra cooperiebat. Ad ejus deinde juſſum ſingulos tollebat canis, et unicuique ſuum reddebat. Similiter diverſorum imperatorum numiſmata permixta et confuſa, nominatim et ſigillatim proferebat. Quinetiam, adſtante virorum ac mulierum circulo, canis interrogatus mulieres uterum geſtantes, ſcortatores, adulteros, parcos et tenues, ac denique magnanimos, idque cum veritate, demonſtrabat. Ex quo eum Pythonis ſpiritu motum dicebant.

* Univerſal magazine, 1766, October, p. 217. A tranſlation may be ſeen in *Neues Bremenſche Magazin*, 1767, ii. p. 217.

† Der entlarvte Wildman, betrüger groſſer höfe. Berlin 1774, 8vo. See alſo *Göttingiſche Gelehrte anzeig.* 1775, p. 816. The name of *impoſtor* given to Wildman was, however, too harſh; for I do not think that he who performs any thing extraordinary, never done by any one before, becomes an impoſtor when another diſcovers his art.

cannot ſay whether the ancients were acquainted with this art; but I ſhall here remark, that it was known in the kingdom of Galam, at Senegal, a hundred years before Wildman: for when Brue, a Frenchman, was there, in 1698, he was viſited by a man who called himſelf the king of the bees. "Let his ſecret," ſays that traveller, "conſiſt in what it may, this much is certain, that they followed him wherever he went, as ſheep do their ſhepherd. His whole body, and particularly his cap, was ſo covered with them that they appeared like a ſwarm juſt ſettled. When he departed they went along with him; for beſides thoſe on his body, he was ſurrounded by thouſands which always attended him *."

In modern times, perſons deſtitute of arms and hands, or who have theſe limbs formed very imperfectly, but who poſſeſs the art of ſupplying that want by the uſe of their feet and toes, ſhew themſelves ſometimes for money; and as they entertain the ſpectators by exciting their wonder, they deſerve from them that ſupport which they are not able to obtain in any other manner. Inſtances of ſuch people who had acquired this art, have been

* The voyage of Brue may be found in Labat's *Afrique occidentale*, iv. p. 200. The paſſage alluded to occurs in *Algemeine hiſtorie der reiſen*, ii. p. 365.

very

very common within the two laſt centuries * ; but, in the works of the ancients, I have found only one.

* The moſt remarkable inſtances of this kind are mentioned by Moſcati, in his treatiſe entitled *Vom unterſchiede zwiſchen der ſtructur der thiere und der menſchen*, Gottingen 1771, 8vo. p. 10. See alſo *Breſlauer Sammlung zur natur und kunſt*, 1770. Febr. p. 200. Sauval in *Hiſtoire de Paris*, ii. p. 544. *Recueil ſervant à l'hiſt. de Henry* III. p. 92. and *Camerarii Horæ ſubciſivæ*, cent. i. 37. p. 170. iii. 80. p. 302.

[Several inſtances of the like kind may be found alſo in *Monſtrorum hiſtoria memorabilis a Joanne Georgio Schenkio a Grafenberg filio*, Francofurti 1609, 4to. p. 28 et ſeq. One of the moſt curious is that of Thomas Schweicker, born at Halle, in Swabia, in the year 1586. The author gives the following account of him from Camerarius, who ſaw him not only write, but even make a pen with his feet : Mira eſt providentia et ſollicitudo naturæ, quam creator omnium rerum ei tanquam optimæ matri attribuit. Ea enim in animalibus membris diſtortis, vel mutilatis aut debilitatis, vel etiam omnino deficientibus, plerumque aliis membris, præter ſuum officium ad quod deſtinata ſunt, tale robur et dexteritatem ex diuturna conſuetudine ſuppeditat, ut dicere aliquis poſſit, non in diſtinctione membrorum ſed in continuo uſu perfectionem conſiſtere. Hac de re ſæpius cogitavi, cum eſſemus Comburgi, apud vere nobilem et præſtantiſſimum virum D. Eraſmum Neienſletterum. Is enim, cum nulla benignitatis erga nos prætermiſiſſet officia, juſſit accerſi ex vicinis ſalinis Suevicis Thomam Schweickerum, natum triginta annos, et quidem honeſtis parentibus. Quem licet mater ſua abſque brachiis enixa fuiſſet in lucem, omnia tamen munia manuum, pedum ſubſidio, ita exequebatur, ut quod in uno deſideraret, in altero ſibi compenſatum eſſe, affirmare non erubeſceret.

Nam cum in editiore loco, qui æquaret altitudinem tabulæ, in qua eſculenta appoſita erant, conſediſſet, apprehenſo pedibus cultro,

one. An Indian king, named Porus, ſent to the emperor Auguſtus an embaſſy with preſents, among which were ſome rare animals, and a man without arms, who with his feet, however, could bend a bow; diſcharge arrows; and put a trumpet to his mouth and blow it. Dio Caſſius confeſſes that he did not know how this was poſſible; but Strabo refers for his authority to Nicolaus of Damaſcus, who ſaw all the preſents as they paſſed through Antioch *. Had this deformed perſon, whom

tro, ſcindebat panem, et alios cibos; pedes ea poſtea, nec non et potum, veluti manus, ori porrigebant. Peracto prandio pedibus pingebat nobis omnibus videntibus, tam elegantes Latinas litteras ac Germanicas, ut exempla earum, quaſi rem inſolitam, nobiſcum ſumeremus. Poſtulantibus etiam nobis, cultello parabat calamos ad ſcribendum aptiſſimos, quos poſtea nobis donabat. Cum eſſet ita occupatus, diligenter inſpexi formam pedum, quorum digiti erant ita oblongi et ad res tenendas apti, ut procul aſpicentibus (pallio enim ſuo verecunde admodum crura tegebat) manus viderentur. Hoc ſpectaculum ſane jucundum, et ante non viſum nobis fuit. Juſſus etiam fuerat, paulo ante, Cæſareæ majeſtati, divo Maximiliano II. cum Halam urbem ad comitia Spirenſia tranſiret, et Electoribus Palatinatus atque Saxoniæ, Ludovico et Auguſto ſe exhibere; quorum Majeſtas et Celſitudo hanc mirandam naturæ compenſationem, non abſque munificentia, et cum admiratione ſpectavit. TRANS.]

* Strabo, lib. xv. p. 1048. ed. Almel. Dio Caſſius, lib. lix. p. 739: Μειρακιον δι ανευ ωμων (οιους τους Ἑρμας ὁρωμεν) εδωκαν. και μεντοι τοιουτον ον εκεινο, ες παντα τοις ποσιν ατε και χερσιν εχρητο. Porro adoleſcens quidam brachiis carens (cujuſmodi Hermæ ſolent) qui, manuum loco, pedum omnia officio peragebat, iis arcum tendebat, ſagittas emittebat, tuba canebat; quod quomodo

whom Strabo compares to a Hermes, travelled about, according to the modern practice, as a ſhow, he would have been better known, and in all probability his example would have induced others to imitate his art *. Manilius ſays, however, that there were people, who, in playing at ball, could uſe their feet with as much dexterity as their hands, who could catch the ball with them, and again throw it back; but the poet, perhaps, did not allude to the ſmall hand-ball, but to the large one which is ſtruck with the fiſt, and which may be ſtopped alſo by the foot. Beſides, the paſſage is read and explained different ways †.

Figures or puppets, which appear to move of themſelves, were employed formerly to work miracles; but they could hardly be uſed for that purpoſe at preſent in any catholic country of Europe,

modo potuerit, equidem neſcio, ab aliis tamen tradita ſcribo. Suetonius, Eutropius, Euſebius, and Oroſius, ſpeak of this embaſſy; but make no mention of the preſents.

* Non enim manus ipſæ hominum artes docuerunt, ſed ratio; manus autem ipſæ ſunt artium organa. *Galen De uſu partium*, 1, 3.

† Caſaubon reads the paſſage in the following manner:

Ille potens curvo pede fundere concita pila,
Ille pilam celeri fugientem prendere planta,
Et pedibus penſare manus et ludere ſaltu,
Perque totum vagas corpus diſponere plantas.

Manilii Aſtron. lib. v. 165.

though

though they ſtill ſerve to amuſe the vulgar. Among theſe are the *marionettes* *, as they are called, the different parts of which are put in motion imperceptibly by a thread. Of a ſtill more ingenious conſtruction are thoſe which are moved by the turning of a cylinder, as is the caſe in the machines with which ſome of the old miners in Germany earn a livelihood; but the moſt ingenious of all are thoſe which are kept in continual movement for a certain time, by the help of wheels with a weight or ſpring. The latter are called *automata*; and, when they repreſent human figures, *androides*. Under the former general name are comprehended our watches, the moſt uſeful of all, and alſo jacks †, with many others.

* Friſch derives this word from *morio* a fool or buffoon.

† This piece of kitchen furniture was known in the middle of the ſixteenth century. Montagne ſaw one at Brixen, in Tyrol, in the year 1580, and wrote a deſcription of it in his Journal, as a new invention. He ſays it conſiſted entirely of wheels; that it was kept in motion by a heavy piece of iron, as clocks are by a weight, and that when wound up, in the like manner, it turned the meat for a whole hour. He had before ſeen, in ſome other place, another driven by ſmoke. *Reiſe*, i. p. 155 and 249. The latter kind ſeem to be ſomewhat older. Scappi, cook to pope Pius V, gave a figure of one, about the year 1570. His book *Opera di M. Bartolomeo Scappi, cuoco ſecreto di Papa Pio* V, is exceedingly ſcarce. See *Theoph. Sinceri Nachrichten von alten büchern*, i. p. 331; *Scheibens Gedanken aus der hiſtorie, critik und litterat.* Frankenthal an der Werra 1737, 8vo. i. p. 171; *Merkwürdigkeiten der Dreſdner bibliothek*, i. p. 396. I lately ſaw a copy, which, inſtead of eighteen, had twenty-four engravings.

This

others. The latter appellation is given to ſmall puppets, which, when their inner works have been wound up, run upon the table or pavement, and as they advance move their head, eyes and hands. They have been exhibited ſometimes under the name of *courrante Margarethe*, which gave riſe perhaps to the word *marionette*.

The proper *marionettes* are very old. They were common among the Greeks, and from them they were brought to the Romans. They were known by the name of *neuroſpaſta*, and were much uſed at their ſhows. Ariſtotle ſpeaks of ſome which moved their head, eyes, hands and limbs in a very natural manner *. They are mentioned with

This work was printed at Venice in 1570, and twice afterwards at the ſame place, viz. in 1571 and 1605, in quarto. The third edition ſays, *con due aggiunte, cio é il Trinciante et il Maeſtro di caſa.* Bayle ſeems to confound this book with that of Platina *De honeſta voluptate*, or to think that the latter was the real author of it. This however cannot be, as there were more than a hundred years between the periods when Scappi and Platina lived. Platina died in 1481, and not in 1581, as we read in Bayle. Scheiben alſo is in an error, when he tells us that Scappi was cook to Paul V: he ſhould have written Pius V.

* De mundo, cap. vi. Ὁμοιως και οἱ νευροσπαστοι, μιαν μηριθεν ἐπισπασαμενοι ποιουσι και αυχενα κινεισθαι, και χειρα του ζυου και ωμοι και ὀφθαλμον. ἐστι δε ὁτε παντα τα μερη μετα τινος ευρυθμιας. Apuleius tranſlates this paſſage as follows: Illi, qui in ligneolis hominum figuris geſtus movent, quando filum membri, quod agitari

with equal preciſion by Galen *, Xenophon †, Antoninus ‡, Horace ||, Gellius §, and others. To theſe belong the *phalli*, which were carried round during the feſtivals of Oſiris and Bacchus, and of which one member only, that properly meant by the name, and which was almoſt as large as the whole body, moved upon certain threads being pulled ¶. Count

tari ſolet, traxerint, torquebitur cervix, nutabit caput, oculi vibrabunt, manus ad omne miniſterium præſto erunt; nec invenuſte totus videbitur vivere.

* De uſu partium. At the end of the third book: Ὅσοι διὰ τινων μηρινθων τα ξυλινα των ειδωλων κινουσιν, επεκεινα των αρθρων εις την κεφαλην μελλοντος κωλου κινηθησεσθαι, καταπτουσιν αυτας. Qui per quoſdam funiculos lignea idola movent, ultra articulos, ad caput coli movendi eos applicant.

† Sympoſium.

‡ De ſe ipſo, ii. 2. iii. 5. vi. 16. vii. 3. xii. 9.

|| Sat. ii. 7, 82.

§ Lib. xiv. 1; where Oiſelius in his notes has collected a great many paſſages; but I doubt much whether the *larva argentea ſic aptata, ut articuli ejus vertebræque in omnem partem laxarentur*, in Petronius, chap. 34, belongs to theſe puppets. In my opinion, the author ſpeaks of an artificial ſkeleton, the different parts of which were moveable in every direction. I think alſo, that a paſſage of Auſonius, in the preface to his *Cento nuptialis*, where he ſpeaks of the σχηματιων, cannot be employed to explain that of Petronius. Auſonius alludes to pieces of ivory cut into geometrical figures, which, for amuſement, were put together ſo as to repreſent various objects, and again ſeparated. Children, in the like manner at preſent, have boxes filled with ſmall bits of wood which they join and form into houſes and other things.

¶ Herodot. ii. 48. p. 127. Feſtum Baccho Ægyptii celebrant, exceptis

Count Caylus has given an engraving of the body of a ſmall puppet, made of ivory or bone; but he requires too much, when he deſires us to conſider that fragment, merely on his word, as a piece of Greek or Roman antiquity. He at leaſt ought to have informed us where it was found, and by what means he procured it. In regard to ſuch articles, it is as eaſy to deceive as to be led into an error; and objects of bone are certainly of no great duration *.

The queſtion concerning the antiquity of automata, properly ſo called, which are moved by wheels, weights and ſprings, I ſhall leave to thoſe who have read the works of the ancient mathematicians, and who may be deſirous of writing on the hiſtory of mechanics. As far as I know, the ancients were not acquainted with the art of making them, unleſs ſome propoſitions of Cteſibius, mentioned by Vitruvius, allude to that ſubject. When clocks were brought to perfection, ſome artiſts added to them figures, which, at the time of ſtriking, performed various movements; and as they ſucceeded in

exceptis choris, fere per omnia eadem Græcis. Sed loco phallorum ſunt ab eis excogitatæ aliæ ſtatuæ circiter cubitales nervis mobiles, quas feminæ circumferunt per pagos, veretro nutante, quod non multo minus eſt cætero corpore.--*Lucian. de Syria Dea*, 16. ed. Bipont. ix. p. 99: Φερουσι ανδρας μικρους εξ ξυλου πεποιημενους, μεγαλα αιδοια εχοντες. Καλεονται δε ταδε νευροσπαστα.

* Recueil des antiquit. iv. p. 259.

theſe,

theſe, ſome attempted to make, detached from clocks, ſingle figures, which either moved certain limbs, or advanced forward and ran. In the middle of the ſixteenth century, when Hans Bullmann *, a padlock-maker at Nuremberg, conſtructed figures of men and women which moved backwards and forwards by clock-work, and beat a drum, and played on the lute according to muſical time, they excited univerſal aſtoniſhment as a new invention. It was about the ſame period that watches came into uſe. The accounts however which ſpeak of much older automata deſerve to be examined with more attention.

The moſt ancient of all are undoubtedly the tripods conſtructed by Vulcan †, which being furniſhed with wheels advanced forwards to be uſed, and again returned to their places. But what was impoſſible to the gods of Homer? An unbeliever might conjecture that theſe tripods, which are mentioned alſo by Ariſtotle ‡, and

* Doppelmayr von Nürnberg. künſtlern, p. 285.

† Iliad. xviii. 373. Tripodas viginti fabricabatur qui ſtarent ad parietem bene fundatæ domus. Aureas autem ipſis rotas unicuique fundo ſubdiderat, ut ſponte ſua divinum ingrederentur cœtum, ac rurſus domum redirent, mirabile viſu. It deſerves to be remarked, that there were alſo ſuch τριποδες αυτοματοι at the banquet of Iarchas. See *Philoſtrat. Opera*, ed. Olearii, p. 117 and 240.

‡ Polit. i. 3.

which perhaps were only a kind of ſmall tables, or dumb-waiters, had wheels ſo contrived, that they could be put in motion and driven to a diſtance on the ſmalleſt impulſe, like the fire-pans in our country beer-houſes, at which the boors light their pipes.

That Dædalus made ſtatues, which could not only walk, but which it was neceſſary to tie, in order that they might not move, is related by Plato *, Ariſtotle, and others. The latter ſpeaks of a wooden Venus, and remarks, that the ſecret of its motion conſiſted in quickſilver having been poured into it †. What the author here means I cannot comprehend; but I do not imagine that this Venus threw itſelf topſy-turvy backwards, like the Chineſe puppets. However this may be, it is aſtoniſhing that the Chineſe ſhould have fallen upon the invention of giving motion to puppets by means of quickſilver, and in ſo ingenious a manner that Muſchenbroek ‡ thought it worth his while to deſcribe their whole conſtruction, and to illuſtrate it by figures. But before this method was known in Europe, Kircher had an idea of putting

* In his Mænon, p. 426. Eutyphron, p. 8 and 11. edition of Francfort 1602, fol.

† Φησι γαρ τον Δαιδαλον κινουμενην ποιησαι την ξυλινην Αφροδιτην εγχεαντα αργυρον χυτον. Theophraſt. De lapid. and Alexand. Aphrodiſ. uſe alſo αργυρος χυτος, inſtead of ὑδραργυρος.

‡ Introduct. in philoſoph. natur. i. p. 143.

a ſmall

a ſmall waggon in motion by adding to it a pipe filled with quickſilver, and heating it with a candle placed below it *. The account of Ariſtotle is more myſterious, for he does not inform us how the quickſilver acted.

Caliſtratus, another writer, who was the tutor of Demoſthenes, gives us to underſtand that the ſtatues of Dædalus were made to move by the mechanical powers †. But what has been aſſerted by Palæphatus ‡, and by Gedoyn ||, Banier §, Goguet ¶, and others among the moderns, is moſt probable. The firſt ſtatues of the Greeks were imitations of thoſe of the Egyptians, for the moſt part clumſy figures, with their eyes ſhut, their arms hanging down cloſe to the body on each ſide, and their feet joined together. Thoſe made by Dædalus had their eyes open, as well as their feet

* Phyſiologia Kircheriana. Amſtelodami 1680, fol. p. 69.

† Caliſtrati Ecphraſis ſeu ſtatuæ, in *Philoſtrati Opera*, ed. Olearii, p. 899 : Δαιδαλου μεν εξην ιδειν, του περι Κρητην, πιστευειν θαυματα, κινουμενα μηχαναις τα ποιηματα, και προς ανθρωπινην αισθησιν εκβιαζεσθαι τον χαλκον. Dædali quidem Cretenſis videre erat, quæ fidem fere ſuperarent, machinis quibuſdam mobilia opera, utque artis vi æs adactum fuerit ad ſenſus humani ſpeciem præbendam.

‡ De Incredib. cap. 22.

|| In Mémoires de l'Academ. des Inſcript. xiii. p. 274, and thence tranſlated into the *Hamburgiſch. magazin*, vii. p. 476.

§ Götterlehre, iv. p. 448.

¶ Urſprung der geſetze und künſte, ii. p. 198.

and hands free; and the artiſt gave them ſuch a poſture, that they ſeemed either reclining, or appeared as if ready to walk or to run. As Anacreon *, ſtruck with wonder, exclaimed when he ſaw a waxen image of his beloved object, "Begone, wax, thou wilt ſoon ſpeak!" the aſtoniſhed Greeks, in like manner, cried out, when they beheld the ſtatues of Dædalus, "They will ſoon walk." The next generation affirmed that they really walked; and their poſterity, adding ſtill to what was told them, affirmed that they would have run had they not been bound.

Equally imperfect is the account given of the wooden pigeon conſtructed by Archytas of Tarentum. We are informed that it flew; but when it had once ſettled, it could not again take flight. The latter is not incredible; but even if we allow that aëroſtatic machines were then known, it is impoſſible to believe the former. At preſent one cannot determine with any probability, what piece of mechaniſm gave riſe to this relation †. The head of Albertus Magnus, which is ſaid not only to have moved but to have ſpoken, is too little known for any opinion to be formed concerning it. The con-

* Ode xxviii: Απεχει. ταχα, κηρε, και λαλησεις.

† Aulus Gellius, x. 12. Profeſſor Schmid of Helmſtadt treats particularly on this dove, in a diſſertation *De Archyta*, printed at Jena in 1683, which I have never had an opportunity of ſeeing.

ſtruction

ſtruction of it muſt have been very ingenious and complex, if it be true that he was employed upon it thirty years *.

In the fourteenth and following centuries, automata, as I have ſaid, were frequently made. Among theſe was the iron fly of John Muller, or Molitor, or, as he is ſometimes called, Regiomontanus, which is ſaid to have flown about; and his artificial eagle, which flew to meet the emperor Maximilian on his arrival at Nuremberg, June the 7th 1470. None of the cotemporary writers however, though they often ſpeak of this very learned man, make the leaſt mention of theſe pieces of mechaniſm; and it is probable that the whole tale originated from Peter Ramus †, who never was at Nuremberg till the year 1571. J. W. Baier ‡ endeavours to prove that the above-mentioned fly, moved by wheel-work, leaped about upon a table; and that the eagle perched upon the town-gate, ſtretched out its wings on the emperor's approach, and ſaluted

* See *Naudé's Apology*, *Bayle's Dictionary*, &c. Thomas Aquinas is ſaid to have been ſo frightened when he ſaw this head, that he broke it to pieces, and Albert thereupon exclaimed; *Periit opus triginta annorum!*

† Schol. mathemat. lib. ii. p. 65.

‡ Diſſertat. de Regiomontani aquila et muſca ferrea. Altorfi 1709. See *Mémoires de Trevoux* 1710, Juillet, p. 1283. I have never read them. *Doppelmayr*, p. 23. *Fabricii Biblioth. med. ætat.* iv. p. 355. *Heilbronner Hiſt. math. Lipſiæ* 1742, 4to. p. 504.

him by an inclination of its body. We know that Charles V, after his abdication, amuſed himſelf during the latter period of his life with automata of various kinds *.

The moſt ingenious, or at leaſt the moſt celebrated automata, were thoſe made by Vaucanſon, which he exhibited publicly at Paris, for the firſt time in 1738. One of them, which repreſented a flute-player ſitting, performed twelve tunes, and, as we are aſſured, by wind iſſuing from its mouth into a German-flute, the holes of which it opened and ſhut with its fingers. The ſecond was a ſtanding figure, which in the like manner played on the Provençal ſhepherd's pipe, held in its left hand, and with the right beat upon a drum, or *tambour de Baſque*. The third was a duck, of the natural ſize, which moved its wings, exhibited all the geſtures of that animal, quacked like a duck, drank water, ate corn, and then, after a little time, let

* Strada De bello Belgico. Moguntiæ 1651, 4to. p. 8. He calls the artiſt Jannellus Turrianus Cremonenſis.—Sæpe a prandio armatas hominum et equorum icunculas induxit in menſam, alias tympana pulſantes, tubis alias occinentes, ac nonnullas ex eis feroculas infeſtis ſeſe haſtulis incurſantes. Interdum ligneos paſſerculos emiſit cubiculo volantes revolanteſque; cœnobiarcha, qui tum forte aderat, præſtigias ſubverente. Fecit et ferreas molas per ſe verſatiles tantæ ſubtilitatis parvitatiſque, ut manica occultatas monachus facile ferret, cum tamen quotidie molerent tantum tritici, quantum hominibus octo in ſingulos dies alendis abunde eſſet.

drop

drop behind it ſomething that reſembled the excrement of a duck *. Theſe pieces muſt have been often imitated. I ſaw ſome of the like kind in the year 1764, at the palace of Zarſko-Selo, near Peterſburg, and was told that they had been purchaſed from Vaucanſon. As far as I can remember, the tambourin was damaged. I ſaw there alſo a regiment of ſoldiers, which went through their exerciſe, moved by wheel-work †.

In the year 1752, one Du Moulin, a ſilverſmith, travelled about through Germany, with automata like thoſe of Vaucanſon. In 1754, he wiſhed to diſpoſe of them to the markgrave of Bayreuth; but he was obliged to pawn them in Nuremberg, at the houſe of Pfluger, who offered to ſell them for 3000 florins, the ſum lent upon them. They were afterwards purchaſed by counſellor Beireis, at Helmſtadt, who was ſo kind as to ſhew them to me. It is much to be regretted that the machinery

* In the year 1738, *Le méchaniſme du fluteur automate, par Vaucanſon,* was printed at Paris, in three ſheets quarto. It contains only a ſhort deſcription of the flute-player, which is inſerted in the *Encyclopédie*, i. p. 448, under the article *Androide*. An extract from it may be found in *Hamburgiſch. magazin*, ii. p. 1, and in *Wiegleb's Magie*, i. p. 283. The duck, as far as I know, has been no where deſcribed.

† I am ſurpriſed that Georgi has not mentioned theſe automata in his *Beſchreibung der ſtadt St. Peterſburg* 1790, 8vo. p. 420. Vaucanſon died at Paris in 1782.

of them is greatly deranged; the flute-player emits only ſome very faint tones; but the duck eats, drinks, and moves ſtill. The ribs, which are of wire, had been covered with duck's feathers, ſo as to imitate nature; and as theſe are now loſt, one can ſee better the interior conſtruction; reſpecting which I ſhall only obſerve, that the motion is communicated by means of a cylinder and fine chains, like that of a watch, all proceeding through the feet of the duck, which are of the uſual ſize. Nicolai * ſays, that Du Moulin came to Peterſburg in 1755, and died at Moſkow in 1765. It is probable that he made the automata which I ſaw in Ruſſia. Thoſe which he left behind him at Nuremberg ſeem either not to have been completed, or to have been deſignedly ſpoiled by him; for they appeared to have defects which could not be aſcribed to any accident. Mr. Beireis however has begun to cauſe them to be repaired.

Of all theſe automata, the duck I confeſs appeared to me the moſt ingenious; but I can prove, that like pieces of mechaniſm were made before the time of Vaucanſon. We are told by Labat †, that the French general De Gennes, who, about the year 1688, defended the colony of St. Chriſ-

* Nicolai Reiſe, i. p. 287.

† Nouveau voyage aux iſles de l'Amerique. A la Haye 1724, 2 vol. 4to. ii. p. 298 and 384. From his county he was called Count de Gennes.

topher

topher againſt the Engliſh, conſtructed a peacock which could walk about, pick up from the ground corn thrown before it, digeſt it, according to appearance, and afterwards drop ſomething that reſembled excrement. This man was of an ancient noble family in Brittany, which had however been ſo reduced, that the father carried on a handy-craft. The ſon became acquainted with the marquis de Vivonne, who, on account of his promiſing talents, bred him to the ſea. He roſe to be commander of a veſſel, conducted a ſquadron to the Straits of Magellan, where it was intended to form a colony, and obtained in Cayenne a tract of land, which he got erected into a county, under the name of Oyac. He invented machines of various kinds uſeful in navigation and gunnery, and, as we are told, conſtructed clocks that moved without weights or ſprings.

The flute-player alſo of Vaucanſon was not the firſt of its kind. In the beginning of the ſixteenth century, the anonymous author of that well-known poem *Zodiacus Vitæ* ſaw at Rome a figure made in the like manner by a potter. It is much to be regretted that no account is given of its conſtruction.

> Vidi ego dum Romæ, decimo regnante Leone,
> Eſſem, opus a figulo factum, juveniſque figuram,
> Efflantem anguſto validum ventum oris hiatu *.

* Zodiacus Vitæ, xi. 846.

I ſhall

I ſhall here beg leave to ſay a few words reſpecting an object of juggling, which, however old it may be, ſtill excites aſtoniſhment, and has often impoſed upon the credulity of men of learning *. I mean thoſe ſpeaking machines, which, according to appearance, anſwer various queſtions propoſed to them, ſometimes in different languages, ſing, and even blow a huntſman's horn. The figure, or only a head, is often placed upon a box, the fore-part of which, for the better deception, is filled with a pair of bellows, a ſounding-board, cylinder and pipes, ſuppoſed to repreſent the organs of ſpeech. At other times the machine is only like a peruke-maker's block, hung round with a Turkiſh dreſs, furniſhed with a pair of arms, and placed before a table, and ſometimes the puppet ſtands upon the table, or againſt a wall. The ſounds are heard through a ſpeaking-trumpet, which the figure holds in its mouth.

Many jugglers are ſo impudent as to aſſert, that the voice does not proceed from a man, but is produced by machinery, in the ſame manner as the muſic of an organ. Some, like the laſt whom I ſaw, are more modeſt or timorous, and give

* See the Erlangiſche Realzeitung 1788, part 53; or a ſmall treatiſe *Ueber H. D. Muller's redende maſchine, und über redende maſchinen überhaupt.* Nurnberg 1788, 8vo. I am acquainted with the latter only by the *Algem. Teutſches biblioth.* vol. lxxxvii, p. 473. The ſpeaking figure and the automaton chefs-player expoſed and detected. London 1784, 8vo.

evaſive

evaſive anſwers to the queſtions aſked them reſpecting the cauſe of the voice, with as much art as thoſe who exhibit with balls and cups. Concerning theſe ſpeaking machines, however, different opinions are entertained. Some affirm that the voice iſſues from the machine; others, that the juggler anſwers himſelf, by ſpeaking as ventriloquiſts do, from the lower part of his belly, or by having the power to alter his voice; and ſome believe that the anſwers are given by a man ſomewhere concealed. The violence with which theſe opinions are maintained expoſes the juggler often to the danger of loſing his life; for, when the illuſion is detected, the populace, who in part ſuffer themſelves willingly to be deceived, and who even pay the juggler for his deception, imagine that they have a right to avenge themſelves for being impoſed on. The machines are ſometimes broken; and the owners of them are harſhly treated as impoſtors. For my part, I do not ſee why a juggler, with a ſpeaking machine, is a more culpable impoſtor than he who pretends to breathe out flames and to ſwallow boiling oil, or to make puppets ſpeak, as in the Chineſe ſhadows. The ſpectators pay for the pleaſure which they receive from a well-concealed deception, and with greater ſatisfaction the more difficult it is for them to diſcover it. But the perſon who ſpeaks or ſings through a puppet, is ſo well hid, that people of conſiderable penetration have imagined

imagined that ſuch concealment was impoſſible. At preſent this art is well known.

Either a child or a woman is concealed in the juggler's box; or ſome perſon, placed in a neighbouring apartment, ſpeaks into the end of a pipe which proceeds through the wall to the puppet, and which conveys the anſwers to the ſpectators. The juggler gives every neceſſary aſſiſtance to the perſon by ſigns previouſly agreed on. I was once ſhewn, in company with Mr. Stock, upon promiſing ſecrecy, the aſſiſtant in another apartment, ſtanding before the pipe, with a card in his hand on which the ſigns were marked; and he had been brought into the houſe ſo privately that the landlady was ignorant of the circumſtance. The juggler, however, acknowledged that he did not exhibit without fear; and that he would not venture to ſtay long at a place like Gottingen, or to return with his Turks, though the populace were ſo civil as to permit him to depart peaceably with what he had gained.

The invention of cauſing ſtatues to ſpeak, by this method, ſeems ſo ſimple that one can ſcarcely help conjecturing that it was employed in the earlieſt periods to ſupport ſuperſtition; and many have imagined that the greater part of the oracles ſpoke in the ſame manner *. This, however, is

* Van Dale De Oraculis. Amſtelod. 1700, 4to. i. 10. p. 222.

falſe,

falſe, as has been proved by the Jeſuit Baltus, and the author of an anſwer to Fontenelle's Hiſtory of oracles *. It appears that the pagan prieſts, like our jugglers, were afraid that their deceptions, if long practiſed, might be diſcovered. They conſidered it, therefore, as more ſecure to deliver the anſwers themſelves; or cauſe them to be delivered by women inſtructed for that purpoſe, or by writing, or by any other means. We read, nevertheleſs, that idols † and the images of ſaints once ſpoke; for at preſent the latter will not venture to open their mouths. If their votaries ever really heard a voice proceed from the ſtatue, it may have been produced in the before-mentioned manner ‡.

Whether the head of Orpheus ſpoke in the iſland of Leſbos, or, what is more probable, the anſwers were conveyed to it by the prieſts, as was the caſe with the tripod at Delphi, cannot with certainty be determined. That the impoſtor Alexander, however, cauſed his Æſculapius to ſpeak

* Réponſe à l'Hiſtoire des Oracles de M. de Fontenelle. The author of this work has not diſcloſed his name.

† A few inſtances are related by Livy, Valerius Maximus, and Plutarch. Among the fables of the Chriſtian church they are more numerous.

‡ The paſſages relating to this ſubject I have already quoted, in a note to *Antigoni Caryſtii Hiſtor. mirabil.* p. 10.

in this manner, is expreſsly related by Lucian *. He took, ſays that author, inſtead of a pipe, the gullet of a crane, and tranſmitted the voice through it to the mouth of the ſtatue. In the fourth century, when biſhop Theophilus broke to pieces the ſtatues at Alexandria, he found ſome which were hollow, and placed in ſuch a manner againſt a wall that a prieſt could ſlip unperceived behind them, and ſpeak to the ignorant populace through their mouths †. I am acquainted with a paſſage which ſeems to imply that Caſſiodorus, who, it is well known, conſtructed various pieces of mechaniſm, made alſo ſpeaking machines; but I muſt confeſs that I do not think I underſtand the words perfectly ‡.

That people ventured more than a hundred years ago to exhibit ſpeaking machines for money, has been proved by Reitz in his annotations to Lucian, where he produces the inſtance of one Thomas Irſon, an Engliſhman, whom he himſelf knew, and whoſe art excited much won-

* Vol. v. p. 90, according to the edition of Deux-Ponts. Commiſſis gruum arteriis, γεράνων ἀρτηρίας, et per caput illud, ad ſimilitudinem humani fabricatum, tranſmiſſis, alio quodam extra inclamante, ad interrogata reſpondit, voce per linteum illum Æſculapium accidente.

† Theodoreti Hiſtor. eccleſ. v. 22. p. 228.

‡ Caſſiodori Variar. i. ep. 45.

der

der in king Charles II. and his whole court. When the aſtoniſhment, however, became general, one of the pages diſcovered, in the adjoining chamber, a popiſh prieſt who anſwered, in the ſame language, through a pipe, the queſtions propoſed to the wooden head by whiſpering into its ear. This deception Irſon often related himſelf.

I ſhall now add only a few obſervations reſpecting the Chineſe ſhadows, which I have occaſionally mentioned before. This ingenious amuſement conſiſts in moving, by pegs faſtened to them, ſmall figures cut of paſteboard, the joints of which are all pliable, behind a piece of fine painted gauze placed before an opening in a curtain, in ſuch a manner as to exhibit various ſcenes, according to pleaſure; while the opening covered with gauze is illuminated, towards the apartment where the ſpectators ſit, by means of light reflected back from a mirror; ſo that the ſhadows of the pegs are concealed. When it is requiſite to cauſe a figure to perform a variety of movements, it is neceſſary to have ſeveral perſons, who muſt be exceedingly expert. When a ſnake is to be repreſented gliding, the figure, which conſiſts of delicate rings, muſt be directed, at leaſt, by three aſſiſtants *.

* A very imperfect deſcription of theſe ſhadows may be found in *Wieglebs Magie*, i. p. 173; and alſo in *Hallens Magie*. Berlin 1783. p. 267.

This amuſement, which one can hardly ſee the firſt time without pleaſure, is really a Chineſe invention. Many years ago, I have ſeen Chineſe boxes on which ſuch moveable figures were apparent only when the box was held againſt the light. In China, theſe ſhadows are uſed at the well known feaſt of lanterns; and a deſcription of them may be found in the works of ſome travellers *. That they were common alſo in Egypt, we are informed by Proſper Alpinus †, who admired them much; but he was not able to diſcover the method by which they were produced, as it was kept a ſecret. I was told by an Italian, who exhibited them at Gottingen, ſome years ago, that they were firſt imitated, from the Chineſe, at Bologna.

* Algemeine hiſtorie der reiſen, vi. p. 178.

† Sunt qui intra ſcenam ex tenuiſſimis linteis paratam latitantes, quadam mirabili arte ex umbris in ſcena productis, faciunt apparere perſonas varias recitantes, cujuſque ſexus et ætatis, atque animalia itidem cujuſcunque generis, prout ad hiſtoriæ repreſentationem eſt opus. - - - Si noſtri comici hanc artem callerent, ut quæ volunt, per umbras repræſentare poſſent, quam admirabiles comœdias facerent, admirabiliaque in ſuarum comœdiarum interſceniis quam minimo ſumtu repræſentare poſſent nimirum per umbras fingentes homines et animalia, domos, arbores, flumina, fontes et quæcunque illis placuerint. *Hiſtoriæ Ægypti natural.* Lugduni Bat. 1735. 4to. p. 60.

CAMEL.

CAMEL.

IN the Zuyder-Zee, oppoſite to the mouth of the river Y, about ſix miles from the city of Amſterdam, there are two ſand-banks, between which is a paſſage called the *Pampus*. This paſſage is ſufficiently deep for ſmall ſhips; but not for thoſe which are large and heavily laden. On this account veſſels, which are outward-bound, take in before the city only a ſmall part of their cargo. They receive the reſt when they have got through the Pampus; and thoſe which are homeward-bound muſt, in a great meaſure, unload before they enter it. For this reaſon the goods are put into ſmall veſſels called lighters; and in theſe conveyed to the warehouſes of the merchants at the city; and the large veſſels are then made faſt to boats *, by means of ropes, and in that manner towed through the paſſage to their ſtations.

Though meaſures were adopted, ſo early as the middle of the ſixteenth century, by forbidding ballaſt to be thrown into the Pampus, to prevent

* Theſe veſſels are called *water-ſchepen*; and, if I remember right, are thoſe in which freſh water is conveyed to Amſterdam.

the farther accumulation of ſand in this paſſage *, that inconvenience increaſed ſo much, from other cauſes, as to occaſion ſtill greater obſtruction to trade; and it, at length, became impoſſible for ſhips of war and others heavily laden to get through it. About the year 1672, no other remedy was known than that of making faſt to the bottoms of ſhips large cheſts, filled with water, which was afterwards pumped out, ſo that the ſhips were buoyed up, and rendered ſufficiently light to paſs the ſhallow. By this method, which was attended with the utmoſt difficulty, the Dutch carried out their numerous fleet to ſea in the above-mentioned year †. This plan, however, gave riſe ſoon after to the invention of the camel, by which the labour was rendered much eaſier.

The camel conſiſts of two half ſhips, built in ſuch a manner that they can be applied, below water, on each ſide of the hull of a large veſſel. On the deck of each part of the camel there are a great many horizontal windlaſſes; from which ropes proceed, through openings in the one half, and, being carried under the keel of the veſſel, enter like openings in the other, from which they

* Amſterdam in zyne opkomſt, aanwas, geſchiedeniſſen beſchreeven door Jan Wagenaar. Amſterdam 1760. 8vo. i. p. 258.

† Le Long, Koophandel van Amſterdam, i. p. 14.

are

are conveyed to the windlaſſes on its deck. When they are to be uſed, as much water as may be neceſſary is ſuffered to run into them; all the ropes are caſt looſe; the veſſel is conducted between them; and large beams are placed horizontally through the port-holes, with their ends reſting on the camel on each ſide. When the ropes are made faſt, ſo that the ſhip is ſecured between the two parts of the camel, the water is pumped from it; and it then riſes, and raiſes the ſhip along with it. Each half of the camel is generally a hundred and twenty-ſeven feet in length; the breadth, at the one end is twenty-two feet; and at the other thirteen. The hold is divided into ſeveral compartments, that it may be kept in equipoiſe while the water is flowing into it. An Eaſt India ſhip, that draws fifteen feet of water, can, by the help of this machine, be made to draw only eleven; and the heavieſt ſhips of war, of ninety or a hundred guns, can be ſo much lightened as to paſs, without obſtruction, all the ſand-banks of the Zuyder-Zee *.

* A complete technical deſcription of the camel with a proper figure I have never yet met with. The beſt figures, which I know, may be found in the following works: *Nieuve Hollandſe Scheeps-bouw - - door Carel. Allard*, Amſterdam 1705. 4to. ii. p. 8. tab. 5. *L'Art de batir les vaiſſeaux.* Amſterdam 1719. 4to. ii. p. 93. *Encyclopédie*, Paris edition, iii. p. 67. *Planches, ſixième livraiſon*, art. *Marine*, tab. v. fig. 2. *Leupold's Theatrum machinarum*, p. 96, tab. 24.

Leupold ſays, that the camel was invented by one Cornelius Meyer; and the ſame account is given by a writer in the German Cyclopædia *. This Meyer was a Dutch engineer; and towards the end of the laſt century was invited to Rome by the Apoſtolic Chamber, to clean the Tyber and render it navigable †. Some of his plans were carried into execution; but the moſt important and greater part of them were never adopted; chiefly through the jealouſy of the Italians. In order to do himſelf juſtice, and prevent others from claiming his inventions, he publiſhed an account of them, in a work ornamented with many beautiful copper-plates ‡. In this work a method is propoſed for carrying large ſhips over ſhallows; which has a great reſemblance to that in which the camel is employed; for the author ſays, that a veſſel muſt be conſtructed in ſuch a manner as to embrace the hull of the ſhip, like a caſe; and that when placed under the ſhip it will raiſe it up ||. But though this machine or caſe, as Meyer

* Vol. iv. p. 815.

† Keyſler's Reiſe, i. p 623. *Volkmann, Nachrichten von Italien*, ii. p. 152.

‡ L'Arte di reſtituire à Roma la tralaſciata navigazione del ſuo Tevere—Dell' Ingegniero Cornelio Meyer, Olandeſe. In Roma 1683. fol.

|| As the book is ſcarce I ſhall here inſert the deſcription, though it refers to a figure which I cannot add. Con occaſione, che mi è convenuto parlare delli ſoſtegni hò voluto toccare di paſ-

Meyer himſelf calls it, is founded on the ſame principles as thoſe on which the camel is con-

ſagio, ch'eſſi ſono ſervibili a moltri altri uſi, et in ſpecie quando ſi trovano nelli canali, ò nel mare ſecchi, ò ſcanni d'arena coperti da coſi poca acqua, che le navi non poſſono paſſare ſopra di eſſi ne proſeguire il loro viaggio. Occorrendo dunque provedere à ſimili incontro, accio le navi non haveſſero da trattenerſi con le merci, e d'aſpettare ſinche viene qualche creſcente d'acqua, pottrebono farſi nel ſudetto ſoſtegno alcune viti fermati dentro le mura di eſſo, e tenere in pronto una ſcafa fatta in forma di caſſa ò fodera d'una nave, la quale ſi pone ſotto alle ſudette viti, e mediante queſte ſi manda tanto ſott' acqua, che la nave puole eſſere tirata in eſſa ſcafa, e rallentate poi dette viti, verrà la medema nave ad alzarſi ſopra acqua, in modo che ſe prima haveva di biſogno per navigare otto ò dieci palmi d'acqua, le baſtaranno cinque, ò ſei. Concioſiache ſe un peſo exempli gratia di cento mila libre manda ſott'acqua il corpo d'una nave da otto in dieci palmi, aggiunto poi à queſta nave il corpo d'una ſcafa, che poſſa portare altretanto peſo ſegue neceſſariamente, ch'eſſa nave peſcarà aſſai meno acqua perche viene ſoſtenuta da un altro corpo, che ricercarebbe altretanto peſo. Il che ſi rende anche più intelligibile con la ſeguente conſiderazione: ſupponiamo, che una nave carica di quattro cento mila libre vadi ſotto acqua palmi dieci, ſi che poſte nella medema nave due cento mila libre ſolamente, reſta indubitato, ch'eſſa nave andarà ſolamente ſott' acqua palmi cinque, perche non porta, che la meta delli ſudette libre quattro cento mila; et il medeſimo opera la ſudetta ſcafa poſta ſotto ad una nave perche ſoſtenta quella con potenza tale, come ſe fuſſe mezza carica, con che credo d'haver à ſofficienza dimoſtrato il modo di poter navigare ſopra i luoghi coperti da poc'acqua, per eſſere queſta propoſitione facile d'eſſere concepita da ogn'uno, e maſſime da chi hà pratica delle materie di queſte genere.

ſtructed, it is different, as it conſiſts of one piece, and can be placed under a ſhip only in a dock, by the help of a number of ſcrews. The author does not ſay that it is provided with pumps; and it muſt indeed be acknowledged that this method would require much more expenſive apparatus than the camel, and muſt be leſs extenſive in its uſe. We do not find, therefore, that it was ever tried or employed. On the contrary, Meyer's account ſeems to prove that, at the time when he wrote, that is, a little before the year 1683, the camel was not invented; for had it been known he would certainly have mentioned it.

The Dutch writers, almoſt unanimouſly, aſcribe the invention of the camel, with more probability, to a citizen of Amſterdam, who calls himſelf Meeuves Meindertſzoon Bakker. Some make the year of the invention to have been 1688, and others 1690. We are aſſured, on the teſtimony of Bakker, written in 1692, and ſtill preſerved, that, in the month of June, when the water was at its uſual height, he conveyed, in the ſpace of twenty-four hours, by the help of the camel, a ſhip of war, called the *Maagt van Enkhuyſen*, which was a hundred and fifty-ſix feet in length, from *Enkuyſen hooft* to a place where there was ſufficient depth; and that this could have been done much ſooner had not a perfect calm prevailed

prevailed at the time *. In the year 1693 he raiſed a ſhip, called *the Unie*, ſix feet by the help of this machine, and conducted her to a place of ſafety.

At later periods, this Dutch invention has been employed in other countries. Ships built in the Newa cannot be conveyed to the harbour, on account of the ſand-banks formed by the current. On one of theſe a trading veſſel from Lubec, in which I was a paſſenger, ran aground in the year 1763. To carry ſhips over theſe ſhoals camels are uſed by the Ruſſians; and they have them of various ſizes. Bernoulli † ſaw one, each half of which was two hundred and ſeventeen feet in length, and thirty-ſix in breadth. Camels are uſed likewiſe at Venice ‡.

But, however beneficial this invention may be, we have reaſon to ſuppoſe that ſuch heavy veſſels as ſhips of war cannot be raiſed up, in ſo violent a manner, without ſuſtaining injury. A ſure proof of this is, the well-known circumſtance, that the ports of a ſhip, which had been raiſed by the camel, were ſo much ſtrained that they could not be ſhut cloſely afterwards ||.

* De Koophandel van Amſterdam, i. p. 14—16.

† Bernoulli Reiſen durch Brandenburg, u. ſ. w. v. p. 23.

‡ See *Wright's Travels*, in the tranſlation of *Blainville's*, iv. p. 68.

|| Muſchenbroek, Introductio ad philoſophiam natur. ii. p. 521.

ARTIFICIAL ICE. COOLING LIQUORS.

THE art of preſerving ſnow, for cooling liquors during the ſummer, in warm countries, was known in the earlieſt ages. This practice is mentioned by Solomon *, and proofs of it are ſo numerous in the works of the Greeks and the Romans, that it is unneceſſary for me to quote them, eſpecially as they have been collected by others †. How the repoſitories for keeping it were conſtructed, we are not expreſsly told; but what I know on the ſubject I ſhall here lay before the reader.

That the ſnow was preſerved in pits or trenches, is aſſerted by many ‡. When Alexander the Great beſieged the city of Petra, he cauſed thirty trenches to be dug, and filled with ſnow, which was covered with oak branches, and which kept in

* Proverbs, chap. xxv. ver. 13: As the cold of ſnow in the time of haveſt, ſo is a faithful meſſenger to them that ſend him: for he refreſheth the ſoul of his maſters.

† Thomæ Bartholini De nivis uſu medico obſervationes variæ. Hafniæ 1661, 8vo.

‡ *Seneca, Quæſt. natur.* iv. 13: Invenimus quomodo ſtiparemus nivem, ut ea æſtatem evinceret, et contra anni fervorem defenderetur loci frigore. In another place he ſays: Didicerunt Romani, luxuria monſtrante, nives ad tempus æſtatis locis ſubterraneis cuſtodire. *Plin.* xix. 4: Servatur algor æſtibus, excogitaturque ut alienis menſibus nix algeat.

that

that manner for a long time *. Plutarch ſays, that a covering of chaff and coarſe cloth is ſufficient †; and at preſent a like method is purſued in Portugal. Where the ſnow has been collected in a deep gulph, ſome graſs or green ſods, covered with dung from the ſheep-pens, is thrown over it; and under theſe it is ſo well preſerved, that the whole ſummer through it is ſent the diſtance of ſixty Spaniſh miles to Liſbon ‡.

When the ancients therefore wiſhed to have cooling liquors, they either drank the melted ſnow or put ſome of it in their wine, or they placed jars filled with wine in the ſnow, and ſuffered it to cool

* Chares Mitylenæus, in ſuis de Alexandro Hiſtoriis qua induſtria nix conſervari debeat, expoſuit, quo loco Petræ urbis Indorum obſidionem enarrat. Scribit enim, Alexandri juſſu foſſas triginta, parum inter ſe diſtantes, excavatas fuiſſe, eaſque nive impletas ſuperinjectis quercus ramis (δρυος κλαδους), ac nivem longo ſic tempore perduraſſe. *Athenæi Deipnoſ.* iii. p. 124.

† Sympoſ. vi. queſt. 6. p. 691. Nivem paleis involventes et rudibus pannis per multum temporis integram retinent. Αχυρις σπαργανουντες αυτην, και περιελλοντες ιματιοις αγναπτοις.—Auguſtinus De civitate Dei, xxi. 4. p. 610: Quis paleæ dedit vel tam frigidam vim, ut obrutas nives ſervet; vel tam fervidam, ut poma immatura maturet?

‡ Memoires inſtructifs pour un voyageur. Or the German tranſlation *Gegenwärtiger ſtaat von England, Portugal und Span.* Danzig 1755, 8vo. i. p. 205. How the ſnow repoſitories at Conſtantinople are conſtructed, is related by Bellon in his *Obſervat.* iii. 22.

there

there as long as they thought proper. It appears that in theſe trenches it could not remain long clean; on the contrary, it was generally ſo full of chaff, that the ſnow-water was ſomewhat coloured with it, and had a taſte of it, and for this reaſon it was neceſſary to ſtrain either it or the wine that had been cooled by it *.

That ice alſo was preſerved for the like purpoſe, is probable from the teſtimony of various authors †, but it appears not to have been uſed ſo much in warm countries as in the northern. Even at preſent ſnow is employed in Italy, Spain and Portugal; but in Perſia, ice ‡. I have never any where

* This circumſtance will make a paſſage of Seneca, *Quæſt. nat.* iv. 13, intelligible: Quid Lacedæmonii feciſſent, ſi vidiſſent reponendæ nivis officinas, et tot jumenta portandæ aquæ deſervientia, cujus colorem ſaporemque paleis, quibus cuſtodiunt, inquinant? The *colum nivarium*, or *ſaccus nivarius*, which occurs in ſeveral paſſages that may be found in Bartholin and Latin dictionaries, was uſed for the above purpoſe. - - - The diſſipated Heliogabalus cauſed whole mounts of ſnow to be heaped up in ſummer in order to cool the air. See *Lampridius*, *Vita Heliogab.* cap. 23.

† Plin. xix. 4: Hi nives, illi glaciem potant. *Seneca:* Nec nive contenti ſunt, ſed glaciem, velut certior illi ex ſolido rigor ſit, exquirunt, ac ſæpe repetitis aquis diluunt. See the paſſage before quoted.—*Latinus Pacatus* in *Panegyr. Theodoſ:* Delicati parum ſe lautos putabant, niſi æſtivam in gemmis capacibus glaciem Falerna fregiſſent.

‡ De la Valle, Reiſen, iii. p. 60, where the Perſian ice-pits are deſcribed, as well as in *Voyages de Chardin*, iv. p. 195.

found an account of Grecian or Roman ice-houſes. By the writers on agriculture they are not mentioned *.

Mankind however ſoon conceived the idea of cooling water without ſnow or ice, from having remarked that it became cold more ſpeedily when it had been previouſly boiled, or at leaſt warmed, and then put in a veſſel among ſnow, or in a place much expoſed to the air. Pliny ſeems to give this as an invention of Nero †; and a jocular expreſſion in Suetonius ‡ makes it at any rate probable, that he was fond of water cooled by this method; but it appears to be much older. It ſeems to have been known even to Hippocrates ||:

* We read in *Joh. Boecleri Diſſert. de potu frigido*, Argentorati 1700, a tranſlation of which may be found in *C. F. Schwertners Kraft und würkung des ſchlechten waſſers*, Leipzig 1740, 8vo. part i. p. 23, that Pliny ſpeaks of the ice-pits as follows: Itali, ut gelu perennet in æſtatem, fontis aquam hyeme in cavum locum deducunt, ut glacie concreſcat; rumpunt ſecuribus glaciem, eamque in turrim profundam ſubſtrata palea ſtipant, turrim implent, glaciem palea tegunt. Theſe words however I cannot find in Pliny, nor do I know whence they have been taken. They ſeem to have been written by ſome modern traveller.

† Neronis principis inventum eſt, decoquere aquam, vitroque demiſſam in nives refrigerare. Ita voluptas frigoris contingit ſine vitiis nivis. Omnem utique decoctam utiliorem eſſe convenit; item calefactam magis refrigerari, ſubtiliſſimo invento. *Hiſt. nat.* xxxi. 3, 23. p. 552.

‡ Vita Neronis, cap. 48: Hæc eſt Neronis decocta.

|| De morbis vulgar. lib. vi. 4. p. 274.

at

at leaſt Galen * believes ſo. And Ariſtotle † was undoubtedly acquainted with it; for he ſays, that ſome were accuſtomed, when they wiſhed water to become ſoon cold, to place it firſt in the ſun and ſuffer it to grow warm. He relates alſo, that the fiſhermen near the Black Sea poured boiling water over the reeds which they uſed in fiſhing on the ice to cauſe them to freeze ſooner. Galen ‡ on this ſubject

* In lib. vi. Hippocrat. de morbis vulgar. comment. 4, 10. p. 396.

† Meteorol. i. cap. 12: Confert adhuc ad celeritatem congelationis et præcalefactam fuiſſe aquam; citius enim infrigidatur. Quapropter multi, cum aquam infrigidare cito voluerint, ad ſolem ponunt primo. Et qui circa Pontum, cum in glacie habitaculum faciunt ad piſcium venationes (venantur enim intercidentes glaciem) aquam calidam arundinibus circumfundunt, propterea quod citius congelatur; utuntur enim glacie tanquam plumbo, ut quieſcant arundines: χρωνται γαρ τῳ κρυσταλλῳ ὡσπερ τῳ μολυβδῳ, ἵνα ἡρεμωσιν οἱ καλαμοι. This paſſage, like many others in the above curious work, deſerves to be more accurately examined.

‡ In the place before quoted. Porro in Alexandria totaque Ægypto ipſos aquam in teſtaceis quibuſdam vaſis hoc modo refrigerare conſpexi. Occidente ſole aquam prius calefactam in vaſcula fundebant, deinde ſublime totum hoc vas in feneſtris vento adverſis, ut ibi per totam noctem refrigeſceret, ſuſpendebant; poſtea ante ſolis ortum vas humi depoſitum frigida aqua circumfundentes, frigida etiam folia toti vaſi circumdabant, nonnunquam vitium, aut lactucæ, nonnunquam vero et aliarum id genus herbarum, ut ea quam ſub nocturno aere acquiſiverat, diutius permaneret frigiditas.—A paſſage alſo in *De compoſit. medic. ſecundum locos*, lib. ii. cap. 1. p. 256, alludes to the ſame cuſtom: Frigidorum fontium multa Romæ, ubertas eſt, et nivis, quemadmodum apud

ſubject is ſtill more preciſe. He informs us that the above practice was not ſo much uſed in Italy and Greece, where ſnow could be procured, as in Egypt and other warm countries, where neither ſnow nor cool ſprings were to be found. The water after it had been boiled was put into earthen veſſels or jars, and expoſed in the evening on the upper part of the houſe to the night air. In the morning theſe veſſels were put into the earth, (perhaps in a pit) moiſtened on the outſide with water, and then bound round with freſh or green plants, by which means the water could be preſerved cool throughout the whole day. Athenæus *, who gives a like account from a book of Protagorides, remarks, that the pitchers filled with water, which had become warm by ſtanding all day long in the ſun, were kept continually wet du-

apud nos in Pergamo et in plurimis Aſiæ Græciæque civitatibus. At vero in calidis regionibus qualis eſt Ægyptus, in qua et fontium frigidorum et nivis penuria eſt, neceſſarium eſt præfrigerato roſaceo per expoſitionem ſub divum per integram noctem et per obverſionem ad auræ alicujus afflatum, ita demum addere ei ſempervivi ſuccum.

* Interdiu aquam inſolantes, et ſub noctem quod craſſiſſimum erat colo ſecernentes, reliquum urnis fictilibus exceptum in excelſiſſima ædium parte ſinunt, pueris duobus tota nocte urnas aqua irrigantibus; diluculo vero urnis deorſum revectis, et fæce quæ ſidit, rurſum detracta, aqua ſic extenuata, et ad tuendam ea ratione bonam valetudinem maxime idonea, urnas in paleis recondunt, et aquam ſic purgatam bibunt, nive prorſus nihil egentes. *Deipnoſ.* iii. p. 124.

ring

ring the night, by ſervants deſtined to that office, and in the morning were bound round with ſtraw. In the iſland Cimolus *, water which had become warm in the day-time was put into earthen jars, and depoſited in a cool cellar, where it grew as cold as ſnow. It was generally believed therefore, that water which had been warmed or boiled, was ſooneſt cooled, as well as acquired a greater degree of refrigeration †; and on this account boiled water is mentioned ſo often in the works of the ancients ‡.

The ſame opinion prevails at preſent in the ſouthern countries of Aſia, and people there ſtill let their water boil before they expoſe it to the air to cool ||. The experiments however which have been made on this ſubject by philoſophers, have proved very different in the reſult. When one indeed places boiling and cold water, all other circumſtances being equal, in froſty air, the latter will become ice before the former has cooled; but when one ex-

* Semus Delius ſcribit, in Cimolo inſula, per æſtatem frigidarias ſpecus effodi, in quibus aquæ tepentis æſtu plena dolia reponant, illam poſt inde haurientes nive ipſa non minus frigidam. *Ibid.* p. 123.

† Alexand. Aphrodiſienſis Quæſt. natur. 1, 51: Δια τι θερμαινομενον ὑδωρ εις φρεαρ χαλωμενον ψυχροτατον ὑδωρ ποιειται. Cur aqua fervida in puteum demiſſa aqua frigidiſſima redditur?

‡ The paſſages have been collected by thoſe authors who are quoted in *Pitiſci Lex. antiq. Rom.* under the word *Decocta*.

|| Philoſophic. tranſact. vol. lxv. part i. p. 126.

poſes

poſes to the cold, water that has been boiled, and unboiled water of equal degrees of heat, it may then be expected that the former will be converted into ice ſomewhat ſooner.

Water by being boiled loſes a conſiderable portion of its air, while that of unboiled water muſt be diſengaged before it can freeze, and by this its particles are kept in continual motion, which may retard its congelation. Boiled water however in cooling, imbibes air again, but for that purpoſe ſeven or eight days are neceſſary, according to the obſervations of Mariotte. One might therefore conjecture that the Indians are right.

The experiments, however, made by Mariotte *, Perrault †, the Academy del Cimento ‡, Marian ‖ and others, ſhewed no perceptible difference in the time of freezing, between boiled and unboiled water; but the former produced ice harder and clearer: the latter ice more full of bliſters. In later times, Dr. Black of Edinburgh has, from his experiments, aſſerted the contrary. Boiled water, he ſays, becomes ice ſooner than unboiled, if the latter be left at perfect reſt; but if the latter be ſtirred ſometimes with a chocolate ſtick, it is con-

* Traité du mouvement des eaux.

† Du Hamel, Hiſt. de l'Academ. l. i. ſ. i. c. 3. p. 99.

‡ Tentamina experimentorum Acad. del. Cim. p. 183.

‖ Diſſertation ſur la glace. Paris 1749, 12mo. p. 187.

verted

verted into ice as ſoon as the former. This difference he explains in the following manner: Some motion promotes congelation; this ariſes in the boiled water, through its re-imbibing air; and, therefore, it muſt neceſſarily freeze before the unboiled; provided the latter be kept at perfect reſt. Fahrenheit had before remarked that water not moved, would ſhew a cold ſome degrees below the freezing point, without becoming ice*.

Mr. Lichtenberg, with whom I converſed on theſe contradictory reſults, aſſured me that he was not ſurpriſed at this difference in the experiments. The time of congelation is regulated by circumſtances, with which philoſophers are not yet ſufficiently acquainted. A certain, but not every degree of ſtirring haſtens it; ſo that every icy particle which is formed on the ſide of the veſſel, or which falls from the atmoſphere, may convert the water ſufficiently cooled into ice inſtantaneouſly; and ſuch unavoidable accidents muſt, where all other circumſtances are equal, cauſe a great difference in the period of freezing. A variation, therefore, in the time may be well expected; both becauſe the boiling of river water expels the aerial acid; and becauſe it produces alſo a kind of inſpiſſation, and becauſe by both theſe effects being produced the water muſt undergo ſome change.

* Philoſoph. tranſact. vol. lxv. part i. p. 124.

I am

I am inclined to think that the cooling of water, in ancient times, of which I have already ſpoken, is not to be aſcribed ſo much to the boiling as to the jars being kept continually wet, and to the air to which it was expoſed. A falſe opinion ſeems therefore to have prevailed reſpecting the cauſe; and becauſe it was conſidered to be the boiling, many have not mentioned the real cauſe, which appeared to them only to afford a trifling aſſiſtance, though it has been remarked both by Galen and Athenæus. We know at preſent that the heat decreaſes by evaporation, or that coolneſs is produced. A thermometer kept wet in the open air, falls as long as evaporation continues. With æther of vitriol, and ſtill better with that of nitre, which evaporates very rapidly, one can in this manner bring water even in the middle of ſummer to freeze; and Cavallo ſaw in ſummer a Fahrenheit's thermometer, which ſtood at 64°, fall in two minutes, by means of æther, to + 3, that is to 29° below the freezing point *.

On this principle depends the art of making artificial ice at Calcutta and other parts of India, between 25° 30′ and 23° 30′ of north latitude, where natural ice is never ſeen. Trenches two feet deep, dug in an open plain, are ſtrewed over with dry ſtraw; and in theſe are placed ſmall ſhallow

* Philoſoph. tranſact. vol. lxxi. part ii. p. 511.

unglazed earthen pans, filled with water at ſunſet. The ice which is produced in them is carried away before ſunriſe next morning, and conveyed to an ice-cellar fifteen feet deep; where it is carefully covered with ſtraw to be preſerved from the external heat and air. A great deal, in this proceſs, depends upon the ſtate of the atmoſphere. When calm, pure, and ſerene, it is moſt favourable to the congelation; but when the winds are variable, or the weather heavy and cloudy, no ice is formed; and the ſame is often the caſe when the nights are raw and cold *.

It was once believed that this freezing was occaſioned principally by the water having been boiled; but it ſeems to be owing much rather to evaporation. It is not, however, ſaid that the veſſels are kept continually wet on the outſide, but that they are unglazed, and ſo porous or little burnt, that the water oozes through them; and on that account their exterior ſurface appears always moiſt †. By veſſels of this kind the trouble

* Philoſoph. tranſact. vol. lxv. part ii. p. 252: The proceſs of making ice in the Eaſt Indies; by Robert Barker. A tranſlation of this paper is inſerted in the *St. Peterburgiſches Journal*, 1776. Januar. p. 59.

† - - - a number of ſmall, ſhallow, earthen pans. Theſe are unglazed, ſcarce a quarter of an inch thick, about an inch and a quarter in depth, and made of an earth ſo porous, that it was viſible from the exterior part of the pans, the water had penetrated the whole ſubſtance.

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of wetting is ſaved. What has been ſaid reſpecting the influence of the weather ſerves, in ſome meaſure, to confirm my conjecture. The more it favours evaporation, the ice is not only formed more eaſily, but it is better; and when evaporation is prevented by the wind or the weather, no ice is produced. The lateſt accounts, how ice is made at Benares, ſay expreſsly that boiled water is not employed; and that all thoſe veſſels, the pores of which are ſtopped by having been uſed, do not yield ice ſo ſoon or ſo good. In porcelain veſſels none is produced; and this is the caſe alſo when the ſtraw is wet *.

Another method of cooling water alſo ſeems to have been known to Plutarch. It conſiſted in throwing into it ſmall pebbles or plates of lead †. The author refers to the teſtimony of Ariſtotle; but this circumſtance I cannot find in the works

* See the account of Lloyd Williams, in the *Univerſal Magazine*, June 1793, p. 410; and a tranſlation of it, in *Lichtenberg und Voigt Magazin für das neueſte aus der phyſick.* Gotha 1794, ix. part 2. p. 86. Thin unglazed veſſels are employed at preſent in Egypt alſo for cooling water, as we are told in ſeveral books of travels. The art of glazing is not yet known in that country. See *Norden's Reiſe durch Egypten.* Breſlau und Leipz. 1779, 8vo. p. 121.

† Sympoſ. vi. 5. p. 690: Διὰ τίνα αἰτίαν ὁι χαλικις και ὁι μολιβδιδες εμβαλλομεναι ψυχροτερον το ὑδωρ ποιουσιν. Quare lapilli et plumbeæ laminæ in aquam injectæ frigidiorem eam faciunt.

of that philoſopher which have been preſerved. It ſeems to be too unintelligible to admit of any opinion being formed upon it; and the explanation given by Plutarch conveys ſtill leſs information than the propoſition itſelf. This is the caſe, in general, with almoſt all the propoſitions of the ancients. We, indeed, learn from the queſtions that they were acquainted with many phenomena; but the anſwers ſcarcely ever repay the trouble which one muſt employ in order to underſtand them. They ſeldom contain any farther illuſtration; and never a true explanation.

It appears that the practice of cooling liquors, at the tables of the great, was not uſual in any country beſides Italy and the neighbouring ſtates, before the end of the ſixteenth century. In the middle of that century there were no ice-cellars in France; for when Bellon relates, in the Account of his travels, in 1553, how ſnow and ice were preſerved at Conſtantinople throughout the whole ſummer, for the purpoſe of cooling ſherbet, he aſſures us that the like method might be adopted by his countrymen; becauſe he had found ice-cellars in countries warmer than France*. The word *glacière* alſo is not to be met with in the oldeſt dictionaries; and it does not occur even in that of

* Obſervation, iii. 22. p. 184.

Monet,

Monet, printed in 1635*. Champier, the phyſician who attended Francis I, when he had a conference with the emperor Charles V and pope Paul III at Nice, ſaw the Spaniards and Italians put ſnow, which they cauſed to be brought from the neighbouring mountains, into their wine in order to cool it. That practice, which excited his aſtoniſhment, he declared to be unhealthful; and this proves that, in his time, it had not been introduced at the French court †.

Grand d'Auſſy quotes an anecdote, related by Brantome, from which he forms the ſame concluſion. The dauphin, ſon of Francis I, being accuſtomed to drink a great deal of water at table, even when he was overheated, Donna Agnes Beatrix Pacheco, one of the ladies of the court, by way of precaution ſent to Portugal for earthen veſſels, which would render the water cooler and more healthful; and from which all the water uſed at the court of Portugal was drunk. As theſe veſſels are ſtill uſed in Spain and Portugal, where the wine is cooled alſo with ſnow, both methods might have been followed in France. I have in my collection of curioſities, fragments of theſe

* That was the fifth edition. The word *glacière*, however, may be found in *Dictionnaire par Richelet*, Geneve 1680, 4to.

† J. Bruyerini Campegii Libri xxii de re cibaria, xvi. 9. p. 669.

Portugueſe veſſels; they are made of red bole; are not glazed, though they are ſmooth, and have a faint gloſs on the ſurface like the Etruſcan vaſes. They are ſo little burnt that one can eaſily break them with the teeth; and the bits readily diſſolve in the mouth. If water be poured into ſuch veſſels, it penetrates their ſubſtance; ſo that, when in the leaſt ſtirred, many air-bubbles are produced; and it at length oozes entirely through them *. The water

* Moſt veſſels of this kind in Portugal are made at Eſtremos, in the province of Alentejo. The deſcription given of them by Brantome is as follows: "Cette terre étoit tannée, ſi ſubtile et ſi fine qu'on diroit proprement que c'eſt une terre ſigillée; et porte telle vertu, que quelque eau froide que vous y mettiez dedans, vous la verrez bouillis et faire de petits bouillons, comme ſi elle eſtoit ſur le feu; et ſi pourtant elle n'en perd ſa froideur, mais l'entretient, et jamais l'eau ne fait mal à qui la boit, quelque chaud qu'il faſſe, ou quelque exercice violent qu'il faſſe." This clay ſeems to be the ſame as that which the ladies in Spain and Portugal chew for the ſake of its pleaſant taſte, though to the prejudice of their health. They are ſo fond of it that their confeſſors make them abſtain from the uſe of it ſome days by way of penance for their tranſgreſſions. See *Madame D'Aunoi, Reiſe durch Spanien*, ii. p. 92 and 109. *Mémoires inſtructifs pour un voyageur*, or the before-quoted tranſlation, *Gegenwärtiger ſtaat von England, Portugal, und Spanien*, ii. p. 162, and Dr. Taube in *Hannoverſches magazin*, 1784, part 75, p. 1199. A veſſel of the above kind is called *bucaro* and *barro*. In *Diccionario Caſtellano, ſu autor El. P. Eſteb. de Terreros y Pando*, it is ſaid: *Bucaro*, poculum ex argilla odorifera confectum. In *Diccion. de la lengua Caſtellana*, Madrid 1783, fol. it is added, that all theſe veſſels are brought to Spain from Portugal or India: *Bucaro*, vaſo de barro

water that has ſtood in them acquires a taſte which many conſider as agreeable; and it is probable that it proceeds from the bark of the fir-tree, with which, as we read, they are burnt. When the veſſels are new, they perform their ſervice better; and they muſt then alſo have a more pleaſant ſmell. If they really render water cold, or retain it cool, that effect, in my opinion, is to be aſcribed to the evaporation. Their ſimilarity to thoſe in which the Indians make ice is very apparent.

Towards the end of the ſixteenth century, under the reign of Henry III, the uſe of ſnow muſt have been well known at the French court, though it appears that it was conſidered by the people as a mark of exceſſive and effeminate luxury. In the witty and ſevere ſatire on the voluptuous life of that ſovereign and his favourites, known under the title of *L'Iſle des Hermaphrodites**, a work highly worthy of notice,

barro fino hecho de tierra oloroſa que traen de Portugal y de las Indias. Sirven para beber agua - - - *Barro*, lutum, argilla. *Barro*, vaſo de differentes figuras y tamaños hecho de tierra oloroſa para beber agua. Llamaſe tambien *Bucaro*. That ſuch veſſels, but of white clay, were made alſo in the iſland of Malta, is affirmed by Bartholin, in his *Epiſtolæ medicinales*, i. p. 224: In Melita ex terra alba fictiles urnas elegantes conficiunt, quæ aquam conſervant frigidam, etiam ſoli expoſitam.

* This curious work contains ſo much valuable information reſpecting the French manners in the ſixteenth century, that ſome account of it may not prove unacceptable to my readers.

notice, but which is exceedingly ſcarce, we find an order of the Hermaphrodites that large quantities of

The edition which I have is entitled, *Deſcription de l'iſle des Hermaphrodites, nouvellement decouverte - - - pour ſervir de ſupplement au Journal de Henry* III. A Cologne, chez les heritiers de Hermann Demen, 1726, 352 pages, 8vo. In the library of our univerſity there is an edition of 1724, which is entirely like the above. Marchand ſays that the name of the place and the publiſher are falſe; and that it ought to have been: *à Bruxelles, chez Francois Foppens.* The preface, to which there is no ſignature, ſays that the book was printed for the firſt time in 1605. In the firſt editions neither date nor place is mentioned; but one edition is dated 1612. It appears to have been written in the reign of Henry IV, after the peace of Vervins, concluded in 1598, which the author mentions in the beginning. Henry IV would not ſuffer any enquiry to be made reſpecting the author that he might be puniſhed, becauſe, he ſaid, though he had taken great liberty in his writing, he had written truth. He is not therefore known. Some have conjectured that it was the production of Cardinal Perron, and others of Thomas Artus. But the former would not have choſen to laſh vices ſuch as thoſe mentioned in this ſatire, with ſo much wit and ſeverity; and the latter could not have done it. The one was too vicious, and the other too vehement. The cardinal muſt have delineated his own picture; and Artus have exceeded what he was capable of. The ſame opinion reſpecting Artus is entertained by Marchand. See the *Gelehrten-Lexicon.* The frontiſpiece, which in many editions is wanting, repreſents an effeminate voluptuary with a womaniſh face, dreſſed half in men's and half in women's clothing. Marchand ſays the inſcription is *Les Hermaphrodites.* In the editions with which I am acquainted it is, however, much more cutting: *Pars eſt una patris, cætera matris habet.* This pentameter is taken from Martial, lib. xiv. ep. 174. The whole work is inſerted alſo in *Journal de Henri* III, par Pierre de l'Eſtoiles, à la Haye 1744,

of ice and ſnow ſhould, every where, be preſerved, in order that people might cool their liquors with them, even though they might occaſion extraordinary maladies, which, it ſeems, were then apprehended *. In the deſcription of an entertainment

1744, 8vo. iv. p. 1; but without the engraving: and ſome pieces which ſtand at the end of my edition, and which could not be in the firſt, becauſe they are of more modern date, are omitted: viz. every thing that follows p. 287, the *Diſcours de Jacoph. à Limue. Privileges, franchiſes et liberté de la ville capitale de Bois-Belle.* (This piece, as mentioned in the margin, ſhould be inſerted in *Recueil de diverſes pieces ſervant à l'hiſtoire de Henry* III: but in my edition, Cologne, chez Pierre du Marteau, 1666, 12mo, which is not to be found in Le Long, it is wanting.) See *Bibliotheque de Madame de Montpenſier*, p. 291; *Remarques ſur la Biblioth. de Mad. de Montpenſier*, p. 298; and *Diſcours ſur la vie du R. Henri* III, par Le Laboureur, p. 331; which may be found alſo in *Mémoires de Caſtelnau*; Paris 1659, fol. p. 883. See *Le Long*, ii. p. 326. n. 19133, who ought properly to have ſaid that it was added to the new editions of *L'Iſle des Hermaphrodites*. I ſhall refer thoſe who wiſh for further information on this ſubject to *Le Long*, *Bibliotheque hiſtorique de la France*, ii. p. 326. n. 19128; and to the works there quoted—*Dictionnaire hiſtorique de Proſper Marchand*, i. p. 305—*Ducatiana*, p. 67. Had the author of the *Gynæologie*, Berlin 1795, been acquainted with this ſatire, he might have extracted from it, to enlarge, in the part on amours, ii. p. 290, the picture which he gives of the manners of the ſixteenth century.

* En été on aura toujours de reſerve, en lieux propres pour cet effet, de grands quartiers de glace et des monts de neige, pour meſler parmi le breuvage, quand bien cela devroit engendrer des maladies extraordinaires. P. 61. There were then no *glacières*, nor was the word known.

we are told that ſnow and ice were placed upon the table before the king; and that he threw ſome of them into his wine *; for the art of cooling it without weakening it was not then known. The ſame method was practiſed even during the whole firſt quarter of the ſeventeenth century †.

Towards the end of the above century this luxury muſt have been very common in France. At that period there were a great many who dealt in ſnow and ice; and this was a free trade which every perſon might carry on. Government, however, which could never extort from the people money enough to ſupply the wants of an extravagant court, farmed out, towards the end of the century, a monopoly of theſe cooling wares. The farmers, therefore, raiſed the price from time to time; but the conſumption and revenue decreaſed ſo much that it was not thought worth while to continue the reſtriction; and the trade was again rendered free. The price immediately fell; and was never raiſed afterwards but by mild winters or hot ſummers ‡.

* On apporta de la neige et de la glace ſur des aſſiettes. L'Hermaphrodite prenoit tantôt de l'une tantôt de l'autre, ſelon qu'il lui venoit en fantaiſie, pour les mettre dans ſon vin, afin de le rendre plus froid. P. 106.

† In the *Contes de Gaulard*, printed in 1620, it is ſaid: Il alla un jour d'eſté ſouper chez un voluptueux, qui lui fit mettre de la glace en ſon vin.

‡ Dictionnaire de commerce, art. *Glace*.

The method of cooling liquors by placing them in water in which ſaltpetre has been diſſolved, could not be known to the ancients, becauſe they were unacquainted with that ſalt. They might, however, have produced the ſame coolneſs by other ſalts which they knew, and which would have had a better effect; but this, as far as I have been able to learn, they never attempted. The above property of ſaltpetre was firſt diſcovered in the firſt half of the ſixteenth century; and it was not remarked till a long period afterwards, that it belongs to other ſalts alſo.

The Italians, at any rate, were the firſt people by whom it was employed; and about the year 1550, all the water, as well as the wine, drunk at the tables of the great and rich families at Rome, was cooled in this manner. Blaſius Villafranca, a Spaniard, who practiſed phyſic in that capital, and attended many of the nobility, publiſhed, in the before-mentioned year, an account of it, in which he aſſerts, more than once, that he was the firſt perſon who had made the diſcovery publicly known *. In his opinion it was occaſioned by the remark

* Methodus refrigerandi ex vocato ſalenitro vinum aquamque, ac potus quodvis aliud genus, cui accedunt varia naturalium rerum problemata, non minus jucunda lectu, quam neceſſaria cognitu. Auctore Blaſio Villa-franca, Medico Hiſpano Romæ. Forty-ſix leaves ſmall quarto. At the end ſtands: Romæ apud Valerium

remark that ſalt water in ſummer was always cooler than freſh water. According to his directions, which are illuſtrated by a figure, the liquor muſt be put into a bottle or globular veſſel with a long neck, that it may be held with more convenience; and this veſſel muſt be immerſed in another wide one filled with cold water. Saltpetre muſt then be thrown gradually into the water; and while it is diſſolving the bottle muſt be driven round with a quick motion on its axis, in one direction. Villafranca thinks that the quantity of ſaltpetre ſhould be equal to a fourth or fifth part of the water; and he aſſures us that, when again cryſtalliſed, it may be employed ſeveral times for the ſame uſe, though this, before that period, had by many been denied. Whether other ſalts would not produce the like effect the author did not think of trying; but he attempts to explain this of ſaltpetre from the principles of Ariſtotle; and he tells his noble patrons what rules they ſhould obſerve for the preſervation of their health, in regard to cooling liquors.

Towards the end of the ſixteenth century this

Valerium et Aloiſium Doricos fratres Brixienſes, anno iubilei, 1550. This edition is in the library of our univerſity. Jocher mentions a Venetian edition of the year 1553, 4to. The *Problemata*, however, do not form a diſtinct work; they make a part of the *Methodus refrigerandi*, and relate only to the deſcribed effects of the ſaltpetre.

method

method of cooling liquors was well known, though no mention is made of it by Scappi, in his Book on cookery. Marcus Antonius Zimara, however, ſpeaks of it in his Problems *. I do not know at what time this Appulian phyſician lived. In a liſt of the profeſſors of Padua † his name is to be found under the year 1525, as *Explicator philoſophiæ ordinariæ*; and becauſe another is named under the year 1532, we have reaſon to conjecture that he died about that time. But in that caſe the phyſician Villafranca would probably have been acquainted with the *Problemata* of Zimara; and would not have ſaid that no one had ſpoken of this uſe of ſaltpetre before him.

Levinus Lemnius ‡ alſo mentions the art of

* Problema 102: Quæſivit dominatio veſtra (Joannes Caſtriota Ferrandinæ dux) propter quod vinum poſitum in vaſe conſtituto in aqua ſalinitro commiſta maxime refrigeſcit. The anſwer no one at preſent would read. Theſe *Problemata* are often printed with the *Problemata Ariſtotelis, Alexandri Aphrodiſ.*, and others. The collection which I have was printed at Amſterdam, by Janſ. Waeſberg, 1685. 12mo.

† Ant. Riccoboni Commentar. de gymnaſio Patavino. Patavii 1592, 4to. p. 22. b.

‡ Æſtivis menſibus ne vinum in congiis cito vapeſcat, aut calore perfundatur, ſed inter propinandum frigeſcat, in labro aqua gelida oppleto collocentur urcei, aut capaciora pocula, deinde ſal nitrum, vulgo *ſalpeter*, inſternatur; tanta frigiditate vinum imbui continget, ut eam vix dentes tolerent. *De miraculis occultis naturæ libri* iv. Coloniæ Agrippinæ, 1581. 8vo. p. 288.

cooling wine by this method ſo much, that the teeth can ſcarcely endure it. We are informed by Bayle that the earlieſt edition of his work, which has been often reprinted, was publiſhed at Antwerp, in the year 1559, in octavo. It contains only the two firſt books; but as the above account occurs in the ſecond book, it muſt be found in this edition.

Nicolaus Monardes, a Spaniſh phyſician *, who died about the year 1578, mentions this uſe of ſaltpetre likewiſe. It was invented, as he ſays, by the galley-ſlaves; but he condemns it as prejudicial to health. From ſome expreſſions which he uſes I am inclined to think that he was not ſufficiently acquainted with it; and that he imagined that the ſalt itſelf was put into the liquor. At a later period we find ſome account of it in various books of receipts; ſuch as that written by Mizaldus in 1566, and which was printed for the firſt time the year following †.

In

* In his treatiſe *De nive*, which Cluſius, in his *Exotica*, has tranſlated from the Spaniſh: Tertius cum nitro refrigerandi modus a nautis inventus, illis præcipue qui triremibus vehuntur; nam cum aer iſtic non refrigeret, præſertim dum malacia eſt, et puteis atque nive ſint deſtituti, neceſſitas hoc remedium eos docuit, licet non bonum propter annexa incommoda. P. 37.

† Noſtro ævo etiam inventus eſt modus refrigerandi aquam ſalnitro, quod aqua diſſolutum egregie illam refrigerat, ſed neceſſe eſt, lagenam, qua vinum vel aqua continetur, continuo agitare,

In the Mineralogy of Aldrovandi, firſt printed in 1648, this proceſs is deſcribed after Villafranca *; but where the editor, Bartholomæus Ambroſianus, ſpeaks of common ſalt †, he relates that it was uſual in countries where freſh water was ſcarce to make deep pits in the earth; to throw rock-ſalt into them; and to place in them veſſels filled with water, in order that it might be cooled. This remark proves that the latter ſalt was then employed for the ſame purpoſe; but it has led the editor into a very groſs error. He thinks he can conclude from it that the intention of potters, when they mix common ſalt with their clay, is not only to render the veſſel more compact, but alſo to make it more cooling for liquors. But the former only is true. The addition of ſalt

tare, quo potus frigidior reddatur, non ſecus ac ſi nivi vel glaciei eſſet impoſita. *Centuriæ* ix *memorabilium*. Francofurti 1599. 12mo. p. 67. Nonnius ſays, in his *Diætetica*, iv. 5, p. 442, that the firſt edition was printed in 1627.

* Aldrovandi Muſæum metallicum, p. 327.

† Figuli maſſam, ex qua vaſa fingunt ad refrigeranda potulenta, ſale congruo aſpergere et ſtatim ſubigere debent, quia ſal argillam aſtringit, et maſſam ad vaſorum conſervationem melius conglutinat; deinde liquores in hujuſmodi vaſis contenti, ope illius ſalis, cito frigeſcunt. Hanc ſalis vim in refrigerando mediterranei noverunt, qui in locis campeſtribus verſantes æſtivis diebus, nullis ſpirantibus auris, ſiti et calore oppreſſi puteos ſiccos effodiunt, in quibus vaſa ad refrigeranda potulenta collocant, quæ ut frigidiora evadant, ſalem potiſſimum foſſilem in fundo puteorum ſubſternunt. P. 317.

produces

produces in clay, otherwiſe difficult to be melted, the faintеſt commencement of vitrification; a coheſion by which the veſſel becomes ſo ſolid that it can contain fluids, even when unglazed; but for this very reaſon it would be moſt improper for cooling, which is promoted by the evaporation of the water that oozes through.

The Jeſuit Cabeus, who wrote a voluminous commentary on the *Meteorologica* of Ariſtotle, which was ready for the preſs in the year 1644, aſſures us that, with thirty-five pounds of ſaltpetre one can not only cool a hundred pounds of water, by quickly ſtirring it, but convert it alſo into ſolid ice; and for the truth of this aſſertion he refers to an experiment which he made *. Bartholin

* Notandum nos experimento didiciſſe, ſi mittamus ſalnitrum in aquam, et illam vehementer ac celeri motu concutiamus et agitemus, poſt aliquem motum, non ſolum frigeſcere illam aquam, ſed congelari etiam, propria et vera congelatione; et ſic delicias, quas in gelato potu quærunt delicatuli, etiam in medio mari, ubi nives non habeantur, inveniunt. Fit igitur glacies admixto ſalnitro competenti cum aqua, centum lib. aquæ infundendo triginta quinque lib. ſalnitri, et poſtea celeriter et vehementer agitata aqua; ut philoſophus magis laboret explicando, quomodo motus ſit cauſſa caloris, cum hic ſit cauſſa frigoris et congelationis. Hic autem pronuntio, quæ experientia nobis ſubminiſtrat. *Nicol. Cabei Philoſophia experimentalis, ſive In libros meteorolog. Ariſtot. commentaria*, Romæ 1686. fol. i. p. 326. Theſe *Commentaria* of Cabeus were printed alſo at Rome in 1646, as mentioned in *Fabric. Biblioth. Græca*, ii. p. 127.

ſays,

ſays, that for the above account he can give him full credit *; but the truth of it is denied by Duhamel, who ſuſpects that this Jeſuit took the ſhooting cryſtals of the ſalt to be ice †. As far as I have been able to learn, no one, in latter times, has ſucceeded to congeal water by ſaltpetre alone, without the help of ſnow or ice. The powder which a duke of Mantua had, in the middle of the laſt century, and by which, as the ſtory goes, water, even in ſummer, could be inſtantaneouſly converted into ice, may, without doubt, have been only ſaltpetre ‡.—Was this ſalt, therefore, conſidered formerly as the cauſe of the cold in the north-eaſtern and other countries, becauſe it was uſed for cooling liquors? Even at preſent many farmers will ſay that ſuch or ſuch a field is cold, becauſe it abounds with ſaltpetre ||.

Who firſt conceived the idea of mixing ſnow or ice with ſaltpetre and other ſalts, which increaſes the cold ſo much, that a veſſel filled with

* De nive, p. 38.

† Joh. Bapt. Du Hamel, Opera philoſophica. Norimbergæ 1681. 4to. tom. ii. p. 50.

‡ Bartholin. De nive, p. 38.

|| When ſnow or ice is mixed with ſalt, both begin to be liquid. This proceſs is employed in Ruſſia to clean windows covered with froſt. They are rubbed with a ſponge dipped in ſalt, and by theſe means they become immediately tranſparent.

water, placed in that mixture, is congealed into a ſolid maſs of ice that may be uſed on the table, I cannot with certainty determine; but I ſhall mention the earlieſt account of it that I have been able to find. Latinus Tancredus, a phyſician and profeſſor at Naples, whoſe book *De fame et ſiti* was publiſhed in 1607, ſpeaks of this experiment; and aſſures us that the cold was ſo much ſtrengthened by ſaltpetre, that a glaſs filled with water, when quickly moved in the above mixture, became ſolid ice *.

* Quod ſalnitrum in aquam immerſum et attenuatum aquas illas ad vehemens frigus adigat; quia, motione, agitatione, cum tenui ſua ſubſtantia aquæ calorem ſecum foras in ambiens diſſipet et diſpergat, inde optime cognoſci poterit; quod ſi phialam aquæ plenam, vel mediam in aqua ſale nitro eliquato circumvolveris, fiet quidem aqua in vaſe frigida; ſed ſi non nitrum, ſed nivem in aquam injeceris, ibique phialam celeri motu convertes, multo quidem plus frigoris illa aqua concipiet, quam ea quæ ſolo ſaliſnitri frigore refrigerabatur.

At vero ſi nitrum nivemque una miſcueris, mox phialam in ſalenitro et nive permixtis agitaveris, jam aqua in phiala contenta non ſolum frigidiſſima evadet, ſed etiam dura glacies fiet. Unde mirabile dictu, niſi frangatur phiala, glacies ſive gelu concretum a vaſe non ſeparabitur.

Et ardente Sirio aquam in glaciem agere non ſolo nitro, nec ſola nive, ſed utriuſque ſubſtantiæ mixtura, res eſt in artis naturæque operibus admirabilis: cur ſcilicet nix adjuncto ſalenitro intenſius refrigeret, atque adeo aquas in gelu permutet. *Latini Tancredi De fame et ſiti libri tres.* Venetiis 1607. 4to. lib. iii. quæſt. 27. p. 170. b.

In the year 1626, the well-known commentary on the works of Avicenna, by Sanct. Sanctorius, was publiſhed at Venice, in folio. The author in this work relates, that, in the preſence of many ſpectators, he had converted wine into ice, not by a mixture of ſnow and ſaltpetre, but of ſnow and common ſalt *. When the ſalt was equal to a third part of the ſnow, the cold was three times as ſtrong as when ſnow was uſed alone.

Lord Bacon, who died in 1626, ſays that a new method had been found out of bringing ſnow and ice to ſuch a degree of cold, by means of ſaltpetre, as to make water freeze. This, he tells us, can be done alſo with common ſalt; by which it is probable he meant unpurified rock-ſalt; and

* The edition of 1626 is quoted by Haller in his *Methodus ſtud. med.* and in *Biblioth. med. pract.* i. p. 324. The following edition I have now before me from the library of our univerſity. *Sanct. Sanctorii Commentaria in primam Fen primi libri Canonis Avicennæ*, Venetiis 1646. 4to. *Quæſt.* 17. p. 177: Similiter nix triplo magis refrigerat, ſi nive permiſceatur tertia pars ſalis communis; ſal enim eſt vehiculum deferens frigiditatem, quod oſtendimus maxima ſcholarium frequentia: nivem cum ſale vel brevi congelaſſe vinum. *Quæſt.* 26. p. 246: Ex nive et ſale pari portione reſultat qualitas adeo frigida (licet ſal calidum ſit), ut duplo magis refrigeret quam nix ſola; tamen dum exoritur iſta intenſa frigiditas, non corrumpitur nix vel ſal, quod patet, quia hæc poſſunt adhuc facile ſeparari.—The above treatiſe may be found alſo in the Collection of all the works of this great man, printed, in four volumes, at Venice, in 1660.

he adds, that in warm countries, where ſnow was not to be found, people made ice with ſaltpetre alone; but that he himſelf had never tried the experiment *. Mr. Boyle, who died in 1691, made experiments with various kinds of ſalt; and he deſcribes how, by means of ſalt, a piece of ice may be frozen to another ſolid body †. Deſcartes ſays, that in his time this was a well-known phenomenon, but highly worthy of attention ‡.

Since that period the art of making ice has been ſpoken of in the writings of all philoſophers

* Hiſtoria vitæ et mortis, § 44: In congelatione et conglaciatione liquorum, quæ nuper cœpit eſſe in uſu, per nivem et glaciem ad exteriora vaſis appoſita, immiſcetur illis nitrum, atque procul dubio excitat et roborat congelationem. Verum eſt, etiam uſurpari ad hoc ſalem nigrum communem, qui potius activitatem indit frigori nivali, quam per ſe infrigidat; ſed, ut accepi, in regionibus calidioribus, ubi nix non cadit, fit congelatio a nitro ſolo; ſed hoc mihi compertum non eſt. *Baconis Opera*, Lipſiæ 1694. fol. p. 528. *De augmentis ſcient.* v. 2. p. 131. *Silva ſilvarum*, cent. i. 83. p. 775.

† Hiſtory of Cold, title i. 17, title v. 3, title xv. 7. The works of Rob. Boyle. London 1774. ii. p. 260, 266, 300.

‡ Meteora, cap. 8: Hinc etiam cauſſas arcani per æſtatem componendæ glaciei diſcere poſſumus; quod licet cum ſatis vulgatum, ex optimis tamen eſt quod ejuſmodi arcanorum ſtudioſi habent. Salem æquali copiæ nivis aut glaciei contuſæ mixtum, [illegible] aliquod vas aqua dulci repletum diſponunt; et ſine alio ar[illegible] illa ſimul ſolvuntur, hæc in glaciem coit. *Des Cartes*, [illegible] *Physicæ*. Amſtelodami 1650, 4to. p. 216.

where

where they treated on heat and cold, and with many other experiments has been introduced into various books of receipts. It was then employed merely for amuſement *; and no one ſuſpected that it would ever be applied to an important purpoſe in luxury. In the like manner Fugger's firſt bills of exchange were ſaid to be uſeful only for gambling; and gun-powder was called a trifling diſcovery.

In the beginning of the laſt century drinking-cups made of ice and iced fruit were firſt brought to the table; but, towards the end of that century, it appears that the French began to congeal, in this manner, all kinds of well-taſted juices, which were ſerved up as refreſhments at the tables of the great and wealthy. This was a grand invention for the art of cookery; which became

* Von Hohberg ſays, in his *Adliches landleben*, Nürnberg 1716. fol. i. p. 88: The following, which ſerves more for amuſement than uſe, is well known to children. If one put ſnow and ſaltpetre into a jug, and place it on a table, over which water has been poured, and ſtir the ſnow and ſalt well round in the jug with a ſtick, the jug will be ſoon frozen to the table." This baron, therefore, who, after he had ſold his property in Auſtria on account of the perſecution againſt the proteſtants, wrote at Regenſburg (Ratiſbon), where he died, in 1688, at the age of ſeventy-ſix, was not acquainted with iced delicacies. Had they been known to him, he would have certainly mentioned them where, in his Book of cookery, he gives ample directions for laying out a table of the firſt rank.

common among the German cooks, both male and female, about the middle of the preſent century; and ſince that time our confectioners ſell ſingle glaſſes of iced articles to the ladies at our balls, and in the theatres.

I am acquainted with no older information reſpecting this invention than what is contained in Barclay's Argenis, which is, indeed, a romance; but the author's account makes the poſſibility of its being uſed ſo clear, that we may certainly conclude it was then employed; eſpecially as he mentions it ſeveral times. Arſidas finds in the middle of ſummer, at the table of Juba, freſh apples, one-half of which were encruſted with tranſparent ice. A baſon, made alſo of ice and filled with wine, was handed to him; and he was informed that to prepare all theſe things in ſummer was a new art. Snow was preſerved the whole year through in pits lined with ſtraw. Two cups made of copper were placed the one within the other, ſo as to leave a ſmall ſpace between them, which was filled with water; the cups were then put into a pail, amidſt a mixture of ſnow and unpurified ſalt coarſely pounded, and the water, in three hours, was converted into a cup of ſolid ice, as well formed as if it had come from the hands of a pewterer. In the like manner apples juſt pulled from the tree were covered with a coat of ice.

The

The firſt edition of the Argenis was printed at Paris in 1621; and in that year the author died at the age of thirty-nine *. The book is far from being ſcarce; but the paſſage to which I allude, is ſo beautiful that I ſhall tranſcribe it to ſave my readers the trouble of ſearching for it †.

After

* Bayle, Diction. hiſt. *Barclai.*

† Arſidas nihil altiori intentione ſpectabat, quam inter promulſidaria eſſe varii generis poma ita glacie circumvenienti inſerta, ut aliorum pars emineret extra hoc frigus, alia prorſus condita, tamen ſub lucentis aquæ cruſta nativo colore cernerentur. - - Tum Juba, Ut magis mireris, inquit, cum in hortum intrâſti, hæc poma adhuc ex arboribus pendebant, et quæ modo eſt glacies, ex fontibus unda manabat. - - Nova eſt, inquit, apud nos hæc ratio revocandi arte hiemem ſub medio ſole. - - Aderat puer Ægyptius cum mulſo, quod in calice præferebat et ipſo ex glacie facto; quo exhauſto cum in terram a puero collideretur, doleretque Arſidas, fragile quidem, ſed in æſtatem pretioſum vas perire; Noli indignari, inquit Juba; in ſingulas potiones uſus ejuſmodi ſcyphorum eſt. Iterato eundem in menſa conſpici, vile eſſet. Nihil amplius guſtabat Arſidas, avidus cognoſcendi, qua arte ad naturæ veritatem ſic perveniretur; cum allata ſunt variarum formarum ex ære prototypa. Orbium, poculorum, paropſidum, omnis denique convivalis inſtrumenti ſpecies erant. Tum Juba: Hæc ſunt clauſtra quæ aquis infuſis glaciem concipiunt. Quippe unumquodque operculo ſuo ſic tegitur, ut oræ invicem cohæreant, excepta foraminis anguſtia, per quam aqua liquitur in interiora, quomodo ex ſtanno vel plumbo fuſilis ſupellex conflatur. Alveolo deinde ligneo illa deponimus, cujus fundum ſale primum nigro illo parumque contuſo, et mox nive, contegitur, quæ nobis ſemper ad manum eſt, fulta ſtraminibus, et in umbra antrorum toto anno inviolata. Supra ipſa deinde prototypa, in alveolum ſic dimiſſa, pari modo nix quoque ali-

After brandy, from being a medicine, came into general uſe as a liquor at table, and was drunk in common by the populace, the Italians, above all, endeavoured to render it weaker and more pleaſant by various mixtures; and by raiſing its value to make it more reſpectable, and, at the ſame time, more uſeful to people of the firſt rank. That their wares might be diſtinguiſhed, with more certainty, they gave them the name of *liquori;* and under that appellation ſold them to foreign nations. The French were the firſt who adopted the uſe of theſe articles; particularly after the marriage of Henry II, when duke of Orleans, with Catherine de Medicis, in the year 1533. This event brought to France great numbers of Italians, who made the French acquainted with theſe delicacies of their native country; and who taught them to prepare and to uſe them. They were the firſt, therefore, who made and ſold the fine *liqueurs* at Paris; and in order to ſerve thoſe who could not bear heating liquors, or rather to

quoties cumulatur, ſale toties interjecto. Ita hæc aqua illo in ære ad glaciem præparata accepit undique circumjectæ nivis frigus, quam ſal acri miſtura vetat liqueſcere; in locis præcipue umbroſis, qualia vini aut olei apothecis effodimus. Trium circiter horarum ſpatio coit aqua, et ſi quæ poma inſeruimus, qualia nunc miraris, hærent ſepta in glacie. Æſtu deinde languentibus grata eſt hæc vis nimii frigoris, quam et ipſa novitas commendat. Nuper enim neſcio cujus non inepta luxuries hoc ſolatium invenit. *Barclaii Argenis.* Norimbergæ 1703. 12mo. lib. v. cap. 5. p. 581.

ſerve themſelves by filling their pockets with money, their ſucceſſors in this buſineſs invented, about the year 1630 or 1633, that beverage called *lemonade*, becauſe the juice of lemons or oranges was its chief component part. This liquor ſoon came into high repute, as it not only ſerved for cooling and refreſhing people during the ſultry heats of ſummer, but was even recommended by phyſicians againſt putrid diſeaſes.

The *limonadiers*, or venders of lemonade, endeavoured to increaſe the firſt property, which occaſioned the far greateſt conſumption, by the means of ice; and one of them, Procope Couteaux, an Italian from Florence, about the year 1660, conceived the happy idea of converting ſuch beverage entirely into ice, by a proceſs which had been before employed only by jugglers. The ready ſale which he found for his invention induced others to make articles of the like kind. His example, therefore, was followed by Le Fevre and Foi; and thoſe three, for ſome years, enjoyed a monopoly of this new-faſhioned commodity. About the year 1676, liquors cooled by, or changed into, ice, muſt, however, have been the principal things ſold by the *limonadiers*; for being then formed into a company, the following delicacies were mentioned in the patent which they received on that occaſion *: *Eaux de gelée et glaces*

* It may be found in *De la Mare, Traité de la police*, iii. p. 799.

de

de fruits et de fleurs, d'anis et de canelle, franchipanne, d'aigre de cetre, du ſorbec, &c. There were at that time in Paris two hundred and fifty maſters in this employment. In 1690, when De la Quintiny wrote, iced liquors were extremely common *.

People, however, long imagined that ſuch articles could be uſed only during the hot months of ſummer. In the year 1750, Dubuiſſon, ſucceſſor to the celebrated Procope, *au café de la rue des Foſsés de S. Germain des Prés*, and author of the *Art du diſtillateur* †, began to keep ready prepared, daily, the whole year through, ices of every kind for the uſe of thoſe who were fond of them. At firſt, they were little called for, except in the dog-days; but ſome phyſicians recommended them in certain diſorders. Have the phyſicians then, by their opinion, done moſt ſervice to the venders of *liqueurs* and to cooks, or the latter to the phyſicians? This would make a fine ſubject for an in-

* Inſtruction pour les jardins. Paris 1730. 4to. i. p. 263. The author ſays that ice in ſummer is indeed uſeful; but, as a gardener, he wiſhes that froſt could be prevented; and that ice might be imported from the North, as olives and oranges are from the South. Some years ago, as no ice could be procured on account of the great mildneſs of the preceding winter, the merchants at Hamburgh ſent a ſhip to Greenland for a load of it, by which they acquired no ſmall profit.

† Der liqueurfabrikant des Demachy und Dubuiſſon, überſetzt und vermehrt von D. Hahnemann. Leipzig 1785. 8vo. ii. p. 165.

augural

augural diſſertation.—It is, however, certain, for we are told ſo by Dubuiſſon himſelf, that after two cures, in which ices had been of the greateſt ſervice, the *more diſcerning* part of the public made uſe of them in every ſeaſon of the year. That this part of the public might never loſe their conceit, the venders of *liqueurs* always employed their thoughts upon new inventions. Among the lateſt is that of iced butter, which acquired its name on account of ſome likeneſs to that ſubſtance. It was firſt known at the Pariſian coffee-houſe *(caveau)* in 1774. The Duke de Chartres often went thither to enjoy a glaſs of iced liquor; and the landlord, to his great ſatisfaction and ſurpriſe, having one day preſented him with his arms formed of eatable ice *, articles of a ſimilar kind immediately became the mode. At preſent, Dubuiſſon will, undoubtedly, ſay, that the Pariſians have loſt all their diſcernment; for where are the Dukes de Chartres ?——

* Ingenioſa gula eſt. *Petron.*

HYDRO-

HYDROMETER.

THIS inſtrument, called in Latin *hydrometrum*, *hygroſcopium*, *hygrobaroſcopium*, *hydroſcopium*, *areometrum* and *baryllion*, ſerves to determine the weight or ſpecific gravity of different fluid maſſes, by the depth to which it ſinks in them. If I am not miſtaken, it is moſt uſed in ſalt-works for diſcovering the contents of ſalt-water.

The laws reſpecting the comparative ſpecific gravity of fluids and ſolid bodies immerſed in them were diſcovered by Archimedes, when he tried the well-known experiment, by order of Hiero, king of Sicily, to find the content of a golden crown, made for that ſovereign. Upon theſe is founded the conſtruction of the hydrometer *; and it is not improbable that Archimedes, who was killed in the year 212 before the Chriſtian æra,

* Directions how to conſtruct and uſe hydrometers may be found in *Karſten's Lehrbegriff der geſammten mathematik*, iii. p. 250; in the *Naturlehre* of the ſame author, p. 177; *Muſchenbroek*, *Introduct. ad philoſoph. natur.* ii. § 1384. *Leupold's Theatr. ſtatic.* pars ii. p. 206. § 12; and *J. Geſner*, *Diſſert. de hygroſcopiis conſtantis menſuræ*, Tiguri 1754. See alſo *De Montigny* in *Mémoires de l'Academ. des Sciences*, 1768, p. 435, and *Faggot*, *Verbeſſerung der bierproben*, in *Abhandl. der Schwediſch. Akadem.* xxv. p. 49. *Krünitz*, *Encyclopedie*, v. p. 272.

was

was the inventor of it, though no proofs to warrant this conjecture are to be found in the writings of that great man, or in thoſe of any other author.

The oldeſt mention of the hydrometer occurs in the fifth century, and may be found in the letters of Syneſius to Hypatia. Of the lives of theſe two perſons I muſt here give ſome anecdotes, as they deſerve to be known on account of the ſingular fate which attended them. Hypatia was the daughter of Theon, a well-known mathematician of Alexandria, ſome of whoſe writings are ſtill extant. By her father ſhe was inſtructed in the mathematics, and from other great men, who at that time abounded in Alexandria, ſhe learned the Platonic and Ariſtotelian philoſophy, and acquired ſuch a complete knowledge of theſe ſciences, that ſhe taught them publicly with the greateſt applauſe. She was young and beautiful, had a perſonable figure, was ſprightly and agreeable in converſation, though at the ſame time modeſt; and ſhe poſſeſſed the moſt rigid virtue, which was proof againſt every temptation. She conducted herſelf with ſo much propriety towards her lovers, that they never could obtain more than the pleaſure of her company and of hearing her diſcourſe; and with this, which they conſidered as an honour, they were contented. Thoſe who wiſhed to intrude farther were diſmiſſed; and ſhe deſtroyed the appetite of one who would not ſuffer her to philoſophiſe, by means of

ſome

ſome ſtrong preparation, which, as far as I know, was never imitated. She was not baptiſed, and, with all her knowledge adopted the blind ſuperſtition of paganiſm. Had ſhe been a Chriſtian, and ſuffered a cruel death from heathen perſecution, ſhe would have merited a place in the martyrology of the ſaints: but the caſe was reverſed; for, by the conduct of the Chriſtians towards her, ſhe became entitled to have her name enrolled in the martyrology of the philoſophers.

The patriarch of Alexandria, at the time when ſhe lived, was Cyrill, whoſe family for a hundred years before had produced biſhops, who were of more ſervice to their relations than to the church. This prelate was a proud, litigious, vindictive and intolerant man, who thought every thing lawful which he conceived to be for the glory of God; and who, as profecûtor and judge, condemned Neſtorius without hearing his defence. In the city of Alexandria, which was then very flouriſhing on account of its commerce, the emperor allowed greater toleration than he imagined could be juſtified to the clergy in any other place; and it contained a great many Jews, who carried on an extenſive trade, as well as a number of pagan families who were of ſervice to the city, or at leaſt did it no harm. This, in the eyes of Cyrill, was not proper; he would have the ſheep-fold clean, and the Jews muſt be baniſhed. Oreſtes, however, the governor,

governor, who was a man of prudence, and better acquainted with the intereſts of the city, oppoſed a meaſure that was likely to be attended with miſchief, and he even cauſed to be condemned to death a Chriſtian profligate, who had done ſome injury to the Jews. This malefactor was, by the order of Cyrill, buried in the church as a martyr; and he immediately collected five hundred monks, who ill-treated Oreſtes in the ſtreets, and excited an inſurrection among the people, who plundered the unfortunate Jews, and expelled them from a city in which they had lived ſince the time of Alexander the Great.

Cyrill, obſerving one day a great number of horſes and ſervants belonging to perſons of the firſt rank, before a certain houſe in the city, enquired the cauſe of their being aſſembled in that manner. He was informed that the houſe was the habitation of the celebrated female philoſopher Hypatia, who, on account of her extenſive learning and eminent talents, was viſited not only by people of the higheſt diſtinction, but even by the governor himſelf. This was ſufficient to excite the biſhop's jealouſy againſt the unbelieving Hypatia, and he reſolved to effect her ruin. As he had inſtigated the people againſt the Jews, he in like manner encouraged them to attack Hypatia. They ſeized her in the ſtreet, hurried her to the church, ſtripped off her clothes, tore her fleſh to pieces with potſherds, dragged

dragged her mangled limbs about through the city, and at length burned them. This bloody tragedy, which took place in the year 415, could tend only to inſpire the heathens with a greater hatred to Chriſtianity, and to make ſenſible Chriſtians aſhamed of the conduct of their brethren. To Cyrill however it occaſioned no ſhame; on the contrary, he endeavoured to divert the emperor from puniſhing thoſe who had been guilty of ſo groſs a violation of the principles of juſtice, and in this he was aſſiſted by his numerous adherents and friends. In ſome circumſtances of this relation, hiſtorians are not agreed, but they all concur in beſtowing praiſe on Hypatia, whoſe memory was honoured and preſerved by her grateful and affectionate ſcholars *.

Among theſe was Syneſius, of a noble pagan family, who cultivated philoſophy and the mathematics with the utmoſt ardour, and who had been one of her moſt intimate friends and followers. On account of his learning, talents, and open diſpoſition, he was univerſally eſteemed, and he had been employed with great ſucceſs on public occaſions of importance. The church at Ptolemais at length wiſhed to have him for their biſhop. After

* A fuller account of Hypatia may be found in *Ægid. Menagii Hiſtor. mulier. philoſophic.* Lugduni 1690, 8vo. p. 52; *Bruckeri Hiſt. critica philoſoph.* ii. p. 351; and *J. G. Wolfii Fragmenta mulierum Græcarum*, Gottingæ 1739, 4to. p. 368.

much

much reluctance he accepted the office, but on condition that they ſhould not expect him to acknowledge the reſurrection of the dead, which he doubted. The people having conſented to allow him this indulgence, he ſuffered himſelf to be baptiſed, and became their biſhop. He was confirmed by the orthodox patriarch Theophilus, the predeceſſor of Cyrill, to whoſe juriſdiction Ptolemais belonged; and he afterwards renounced his errors, and declared himſelf convinced of the truth of the reſurrection. This learned man ſhewed his gratitude to Hypatia, by the honourable mention which he made of her in ſome letters that are ſtill preſerved among his writings *.

In his fifteenth letter, he tells Hypatia that he was ſo unfortunate, or found himſelf ſo ill, that he wiſhed to uſe a *hydroſcopium*, and he requeſts that ſhe would cauſe one to be conſtructed for him. "It is a cylindrical tube," adds he, "of the ſize of a reed or pipe. A line is drawn upon it lengthwiſe, which is interſected by others, and theſe point out the weight of water. At the end of the tube is a cone, the baſe of which is joined to that of the tube, ſo that they have both only one baſe. This inſtrument is called *baryllion*. If it be placed

* Reſpecting Syneſius ſee *Bruckeri Hiſt. philoſ.* iii. p. 511; and *Fabricii Biblioth. Græca*, viii. p. 219, 221. He died in the year 431.

in water, it remains in a perpendicular direction, ſo that one can diſcover by it the weight of the fluid *."

Petau, who publiſhed the works of Syneſius in the year 1640, acknowledges in his annotations, that this paſſage he did not underſtand. An old ſcholiaſt, he ſays, who had added ſome illegible words, ſeemed to think that it referred to a water-clock; but this he conſiders improbable, as a clepſydra was not immerſed in water, but filled with it. He conjectures therefore, that it may allude to

* That my learned readers may judge for themſelves, I think it neceſſary to tranſcribe the whole letter, though it may be found entire, with Petau's annotations, in Wolf's *Fragmenta mulier. Græcarum*. Ουτω πανυ πεπραγα πονηρως, ὡστε ὑδροσκοπιου μοι δει. επιταξον αυτο χαλκευθηναι τε και συνωσθηναι. Σωλην εστι κυλινδρικος, αυλου και σχημα και μεγεθος εχων. ουτος επι τινος ευθειας δεχεται τας κατατομας, αἰς των ὑδατων την ῥοπην εξεταζομεν. Επιπωματιζει γαρ αυτον εκ θατερου κωνος κατα θεσιν ισην εγκειμενος ωστ' ειναι κοινην βασιν αμφοιν του κωνου τε και του σωληνος. Λυτο δη τουτο εστι το Βαρυλλιον. Οταν ουν εις ὑδωρ καθης τον αυλον, ορθος εσηξει και παρεξει σοι τας κατατομας αριθμειν· αι δε της ῥοπης εισι γνωρισματα. Eo ſum infortunii redactus, ut hydroſcopio opus habeam; jube mihi fabricari ac coemi. Tubulus eſt cylindri figuram habens, tibiæ magnitudine forma. Hic in una recta linea inciſiones habet, quibus aquarum libramentum cognoſcimus. Obturat enim illum altera ex parte conus, æquabili poſitu inſertus, ita ut communis ſit amborum baſis, coni videlicet atque tubuli. Hoc ipſum eſt, quod Baryllium appellant. Jam cum tubulum in aquam depoſueris, erectus ſubit, ut in eo inciſiones facile numerare poſſis, ex quibus libramentum cognoſcitur.

ſuch an inſtrument as that called by Vitruvius *chorobates*. The latter however was employed for levelling; and it appears that Syneſius, who complains of the bad ſtate of his health, could not think of levelling. Beſides, no part of the deſcription in Vitruvius agrees with that which is given in ſo clear a manner by Syneſius.

Petau publiſhed his edition of the works of this philoſopher in the time of Peter de Fermat, *conſeiller au parlement de Toulouſe*, a man of great learning, who was an excellent mathematician, and well acquainted with antiquities and the works of the ancients. We have by the latter a commentary upon ſome obſcure paſſages of Athenæus, annotations on the writings of Theon of Smyrna, and emendations from a manuſcript to the *Stratagemata* of Polyænus, which may be found alſo in his Miſcellanies *. Murſinna, in his edition of the ſame author, has added them to the end of the preface. As Fermat was often conſulted reſpecting difficult paſſages of the ancients, he could not be unacquainted with that in the new edition of Syneſius. He drew up an explanation of it, and gave it to a friend who was then about to publiſh a French tranſlation of Bened. Caſtelli's book *Della miſura dell'acque correnti*, and who cauſed it to be printed along with that work. Fermat died in the year 1665, which

* Opera varia, p. 205.

I remark becauſe it has not been mentioned in the Dictionary of learned men *. After his death his ſon publiſhed ſome of his writings under the title of *Varia opera mathematica* †; and in this collection is inſerted his ſhort treatiſe on the *hydroſcopium* ‡, from which I have extracted the following explanation.

It is impoſſible, ſays he, that the *hydroſcopium* could be the level or *chorobates* of Vitruvius, for the lines on the latter were perpendicular to the horizon, whereas the lines on the former were parallel to it. The *hydroſcopium* was undoubtedly a hydrometer of the ſimpleſt conſtruction. The tube may be made of copper, and open at the top; but at the other end, which, when uſed, is the loweſt, it muſt terminate with a cone, the baſe of which is ſoldered to that of the tube. Lengthwiſe, along the tube, are drawn two lines, which are interſected by others, and the more numerous theſe diviſions are, the inſtrument will be ſo much more correct. When placed in water, it ſinks to a certain

* I know the year from his *Eloge* in the *Journal des Sçavans* 1665, Fevr. to which the ſon prefixed a liſt of his father's works which he publiſhed.

† Varia opera mathematica D. Petri de Fermat, ſenatoris Toloſani. Acceſſerunt quædam ejuſdem epiſtolæ. Toloſæ 1679, 210 pages folio.

‡ It was made known by an extract alſo in the *Journal des Sçavans*, 1679, Jan.

depth,

depth, which will be marked by the croſs lines, and which will be greater in proportion to the lightneſs of the water *. A figure, which is added †, illuſtrates this explanation more than was neceſſary. When a common friend of Fermat and Petau ſhewed it to the latter, he conſidered it to be ſo juſt, that he wiſhed to have an opportunity of introducing it in a new edition.

Merſenne, on the other hand, entertains ſome doubt ‡ reſpecting this inſtrument, though he does not mention Fermat, with whom he was well acquainted; for in the diſpute which the latter had with Deſcartes, Merſenne was the bearer of the letters that paſſed between them, as we learn from the Life of Deſcartes, by Baillet ‖. His objections however are of little weight. Why ſhould Syneſius, aſks Merſenne, conſider himſelf unfortunate, becauſe he had not a hydrometer?—It may be here

* Fermat here remarks, that ῥοπὴ, which the editor wiſhed to change, ought to be retained, but that it ſhould not be tranſlated by *libramentum* but *momentum*. In a mechanical ſenſe it ſignifies the weight; and on this account the books of Archimedes de *æquiponderantibus* are called ἰσορροπικῶν.

† This may be found alſo in the *Journal des Sçavans*.

‡ In Cogitata phyſico-mathematica. Pariſiis 1644, 4to. and in *Phænomena hydraulica*, p. 209.

‖ La vie de M. Des Cartes. Reduite en abregé. Paris 1693, 8vo. p. 112.

replied, that he was in an infirm ſtate, and that the phyſicians ſeem to have ordered him to drink no water but what was pure and light. We know that in former times, when ſo many artificial liquors were not in uſe, people were accuſtomed, more than at preſent, to good water. We read in the works of the ancient phyſicians, ſuch as Galen and Celſus *, directions how to examine the lightneſs and purity of water. He might have tried it, ſays Merſenne, with a common balance. He indeed might, but not ſo conveniently. ThatSyneſius was in a bad ſtate of health is apparent from ſeveral of his letters; otherwiſe one might ſay that in a letter many expreſſions may be only jocular, reſpecting ſome circumſtance known to the friend to whom one writes; and that every expreſſion is not to be taken according to its literal meaning. One might confeſs alſo, without weakening a received explanation, that one does not know to what Syneſius alludes in the firſt line of his letter. But even if we allow that the inſtrument was not a hydrometer, but a water-clock, or a level; it may be aſked how the want of theſe could make him unfortunate. Merſenne thinks farther, that the cone, added to the end of the tube, would have been unneceſſary in an hydrometer; but it ſerves to keep the inſtrument with more eaſe in a perpendicular

* Lib. ii. cap. 18. p. 100.

direction

direction in the water *. Such is the opinion of H. Klugel, whom I ſhall ſoon have occaſion to quote.

For the explanation of Fermat one may produce a ſtill ſtronger teſtimony, with which he ſeems not to have been acquainted. It can be proved that this inſtrument was uſed in the next, or at leaſt in the ſixth century. Of that period we have a Latin poem on weights and meaſures, which contains a very juſt deſcription of an hydrometer. The author, in manuſcripts, is called ſometimes *Priſcianus*, and ſometimes *Rhemnius Fannius Palæmon*; but we know, from grounds which do not belong to this ſubject, that the former was his real name. Two perſons of that name are known at preſent. The one, Theodore Priſcian †, was a phyſician, and lived in the time of the emperor Valentinian, towards the end of the fourth century. As more phyſicians have written on weights and meaſures, with which it is indiſpenſably neceſſary they ſhould be acquainted, one might conjecture that this Priſcian was the author of the above poem. The

* As I do not know whether I underſtand this objection perfectly, I ſhall here add his own words: Non video, cur baryllii ſuperficiem ſuperiorem cono voluerit obturari, cum baſis cylindri ſuperior ex eadem ac cylindrus ipſe materia ſufficiat, niſi forſan in coni vertice pinnula quædam ad aquæ libramentum addita fuerit.

† Haller, Biblioth. botan. i. p. 151.

neſt of his writings, however, ſtill preſerved, are in ſo coarſe and heavy a ſtyle, that one can ſcarcely aſcribe to him a work which is far from being ill written; eſpecially as one no where reads that he was a poet. With much more probability may we conſider as the author the well-known grammarian Priſcian, who died about the year 528.

This poem has been often printed, and not unfrequently at the end of *Q. Sereni Samonici De medicina præcepta*. The beſt edition is that inſerted by Wernſdorf in the fifth part of the firſt volume of his *Poetæ minores* *, where an account may be found of the other editions.

Be the author who he may, this much is evident, that he was acquainted with the hydrometer of Syneſius, and has deſcribed it in a very clear manner †.

" Fluids,"

* Page 238 and p. 248.

† I ſhall here inſert the whole paſſage:

Illud præterea tecum cohibere memento,
Finitum pondus varios ſervare liquores.
Nam libræ, ut memorant, beſſem ſextarius addet,
Seu puros pendas latices, ſeu dona Lyæi.
Addunt ſemiſſem libræ labentis olivi,
Selibramque ferunt mellis ſupereſſe bilibri.
Hæc tamen aſſenſu facili ſunt credita nobis;
Namque nec errantes undis labentibus amnes,
Nec merſi puteis latices, aut fonte perenni

Manantes,

"Fluids," ſays he, "are different in weight, as may be proved by the ſpecific gravity of oil and honey compared with that of pure water;" and the given proportion agrees almoſt with that found by modern experiments. "This," adds he, "may be diſcovered by an inſtrument," which he thus deſcribes: "It conſiſts of a thin metallic cylinder made of ſilver or copper, about as large as the joint of a reed between two knots, to the end of which is added a cone. This cone makes the

Manantes, par pondus habent: non denique vina,
Quæ campi aut colles nuperve aut ante tulere;
Quod tibi mechanica promptum eſt deprendere Muſa.
Ducitur argenti, tenuive ex ære, cylindrus
Quantum inter nodos fragilis producit arundo,
Cui cono interius modico pars ima gravatur,
Ne totus ſedeat, totuſve ſupernatet undis;
Lineaque a ſummo tenuis deſcendit ad ima,
Ducta ſuperficie; tot quæque in fruſta ſecatur,
Quot ſcriplis gravis eſt argenti æriſve cylindrus.
Hoc cujuſque potes pondus ſpectare liquoris;
Nam ſi tenuis erit, majori mergitur unda;
Sin gravior, plures modulos ſupereſſe notabis.
Aut ſi tantundem laticis ſumatur utrimque,
Pondere præſtabit gravior; ſi pondera ſecum
Conveniunt, tunc major erit, quæ tenuior unda eſt.
Quod ſi ter ſeptem numeros texiſſe cylindri
Hos videas latices, illos cepiſſe ter octo,
His drachma gravius fatearis pondus ineſſe;
Sed refert æqui tantum conferre liquoris,
Ut gravior ſuperet drachma, quantum expulit undæ
Illius aut hujus, teretis pars merſa cylindri.

Wernſdorf, p. 510.

lower

lower end ſo heavy, that the inſtrument, without ſinking or floating on the ſurface, remains ſuſpended perpendicularly in the water. Lengthwiſe, upon the cylinder, is drawn a line, which is divided by croſs lines into as many parts as are equal to the weight of the inſtrument in *ſcripla*. If placed in light fluids, more of the diviſions will be covered than when put into heavy fluids; or it ſinks deeper into thoſe which are light than into thoſe which are heavy. This difference of gravity may be found alſo," continues he, "by filling veſſels of equal ſize with the fluids and weighing them; for the heavier muſt then weigh moſt; but when one takes an equal weight of two fluids, the lighter will occupy more ſpace than the heavier. If twenty-one diviſions of the inſtrument are covered in water, and twenty-four in oil, and if one take twenty-four *ſcripla* of water, twenty-one *ſcripla* of oil only can be contained in the ſpace occupied by the water." Such is the manner in which profeſſor Klugel has conjectured the meaning of the author from hydroſtatical principles; though neither he nor Wernſdorf has ventured to give a literal tranſlation of the words which ought to convey this explanation. But, however obſcure they may be, it evidently appears that they allude to a hydrometer.

This poem was once publiſhed together with *Celſus De re medica*, in 1566*, by Robert Conſtantin,

* Lugduni, 1566. 8vo.

who

who died, at an advanced age, in 1605, and who added a few, but excellent, notes, which have been inſerted by Wernſdorf in his edition. This Conſtantin ſeems to have known that the inſtrument of Priſcian and the *hydroſcopium* of Syneſius were the ſame; and that they were uſed for determining the weight of fluids. He explains the uſe of them very properly; but is miſtaken in ſuppoſing the cone to have been of wood, though it ſerved to render the lower part of the inſtrument heavier, as the poet himſelf ſays: *cui cono interius modico pars ima gravatur*. I am almoſt induced to think that *interius* implies that additional weight was given to the cone by throwing ſome ſmall heavy bodies into it, through the opening above; and at preſent grains of leaden ſhot are employed for that purpoſe. It appears therefore that the honour of having firſt given a good explanation of the before-quoted paſſage of Syneſius belongs rather to Conſtantin than to Fermat; but I can readily believe that the latter was not acquainted with the obſervations made on it by the former *.

Before

* Conſtantin refers to the word βαρυλλιον in his Dictionary, and, as I expected to find there farther elucidation, I conſulted it. The firſt edition of his Greek Dictionary was, as Conr. Geſner ſays, printed at Geneva in 1562. This I could not procure, but the other, enlarged by Francis Portus and others, Geneva 1592, I have now before me. The word βαρυλλιον, to which the author refers, I cannot meet with, and the explanation given under

Before I conclude the hiſtory of this inſtrument among the ancients, I ſhall add two remarks further. It is evidently wrong when one, with Muſchenbroek and others, whoſe opinion I adopted before I engaged in this reſearch *, conſiders Hypatia as the inventreſs of the hydrometer. It was known at her time, and was made at Alexandria; but it ſeems not to have been very common, as Syneſius wrote to Hypatia to procure him one, and even thought it neceſſary to give her a deſcription of it.

Thoſe are miſtaken likewiſe, who ſay that this

under ὑδροσκοπιον, which is entirely different from that of the editor of Priſcian, is as follows: *clepſydræ genus qua horæ diſcernuntur, deſcriptum a Syneſio.* I ſuſpect therefore that Conſtantin in 1566 was firſt led to a right comprehenſion of Syneſius by the account of Priſcian; and that he referred to his Dictionary, printed four years before, without examining whether the word had been there introduced. That reference is conſequently of no uſe. In the well-known Dictionary of Baſle, however, printed in 1572 and 1577, in which that of Conſtantin and other dictionaries are inſerted entire, I find the word βαρυλλιον, hydroſcopii pars apud Syneſium, and under ὑδροσκοπιον the explanation before mentioned. Beſides theſe two editions, I am acquainted with one of 1558 and another of 1565. All the four are *ex officina Henricpetrina;* but in the two laſt the word βαρυλλιον does not occur. I have remarked this occaſionally reſpecting a dictionary printed ſo often in the courſe of a few years. See *Morhofii Polyhiſt.* tom. i. p. 808.

* In the fourth edition of my Technology, juſt publiſhed, p. 174. § 15, 1.

inſtrument

inſtrument was called alſo *baryllium*. That word, as far as I have been able to learn, occurs only in Syneſius, who expreſsly tells us that the ſmall heavy cone alone was meant by it. In the ſame manner has it been underſtood by Conſtantin. In the Dictionary of Baſle it is ſaid to be *hydroſcopii pars*; and in Stephen's Dictionary it is explained by *ponduſculum*, as well as in that of Erneſt, where it is given as the diminutive of *baros*. It ſignified therefore the heavy part of the hydrometer only.

It is equally erroneous when one ſays, with Muſchenbroek and others, that thoſe who among the Romans made it their employment to examine the quality of water with the hydrometer, were called *barylliſtæ* or *barynilæ*. Theſe words do not occur in the works of the ancient Latin authors, nor in any of the completeſt dictionaries. We read only the following paſſage in ſome editions of the Commentary of Servius upon Virgil: *Scrutatores et repertores aquarum (aquilices dicuntur) barinulas dixerunt* *. If theſe words were really written

* On Georg. I. 109. Theſe words are quoted by Emmeneſſius and Ægid. Menage in *Juris civilis amœnitat.* Francof. et Lipſ. 1680. 8vo. p. 412: but in the edition of Servius, Venetiis 1562, fol. p. 51. a. which I have in my poſſeſſion, they are not to be found. The Commentary of Servius may, at preſent, be no farther neceſſary for explaining Virgil; but it deſerves to be printed

ten by Servius, who lived in the fifth century, he either confounded the water-ſearchers, *aquilices*, thoſe who ſought for ſprings, with thoſe who examined the nature of water when found, as the hydrometer was of no ſervice to the former in their buſineſs, or both employments muſt at that time have been followed by the ſame people, and theſe muſt have acquired their name from a part only of one inſtrument they uſed, which is not at all probable.

I think we may with certainty believe that the hydrometer was not known to Seneca, Pliny, or Galen, who died about the end of the ſecond century. Were not this the caſe, it would certainly have been mentioned by the firſt, where he ſpeaks ſo minutely of the ſpecific gravity of hard and fluid bodies *; by the ſecond, where he ſays that the weight of water was aſcertained by a common balance †; and by the laſt, where he gives directions how to diſcover its lightneſs. Galen adds that, in his time, a method had been invented of

printed once more as completely and accurately as poſſible. It contains much uſeful information, as well as many fragments of works now loſt; and on this account cannot well be entirely diſpenſed with.

* Quæſt. nat. iii. 25. p. 726.

† Hiſt. nat. xxxi. 3. ſect. 23. p. 552: Quidam ſtatera judicant de ſalubritate, fruſtrante diligentia, quando perrarum eſt, ut levior ſit aliqua. *Athen.* ii. p. 46. *Plutarchi Quæſt. nat.* 7.

determining

determining the quality of ſalt-lye by placing an egg in it, and obſerving whether it floated *. Have we not reaſon to think that, on this occaſion, the hydrometer muſt have occurred to him had it been then uſed ?

But however well known it may have been in the fifth century, it ſeems that it was afterwards entirely forgotten, and that, towards the end of the ſixteenth, it was again, for the firſt time, revived or invented anew. To George Agricola it was ſcarcely known ; for where he ſpeaks of the weight of different kinds of water, and particularly of that of ſalt ſprings †, he does not mention it. Conſtantin, however, who lived at the ſame time, muſt have been acquainted with it, elſe he could not have explained the before-mentioned paſſages of Syneſius and Priſcian.

I am inclined to think that the firſt account of

* De ſimplic. med. facultatibus, iv. 20. p. 61. ed. Geſneri. Quin et modum jam invenerunt, moderatam ad ſaliendum conficiendi ſalſuginem, ſi ovum in ea videatur natare. Nam ubi etiamnum ſidit, ac nondum ſuper ſalſuginis ſuperficiem innatat, aquoſa magis eſt et dulcis ; graviter vero ſalſa, ubi tanta eſt ſalis copia indita, ut amplius liquari qui poſtea adjicitur nequeat. Αλλα και μετρον ηδη τι πεποιηνται του την ακμην εικρατον υπαρχειν εις ταριχειας, ει φαινοιτο κατ' αυτην επιπλεον ων. This paſſage occurs in the Greek edition of Baſle, part ii. p. 52. 49.

† De natura eorum quæ effluunt ex terra, lib. ii. p. 124.

the

the hydrometer being again brought into uſe, muſt be found in the oldeſt German books on ſalt-works. It is, at any rate, certain that from theſe the modern philoſophers became firſt acquainted with it. One of the earlieſt who has deſcribed it is the Jeſuit Cabeus, who wrote about the year 1644 *; but he confeſſes that he acquired his information from a German treatiſe by Tholden, whom Kircher † calls a German artiſt. He was, however, not properly an artiſt. He was a native of Heſſe; a good chemiſt for his time; and reſided about the year 1600 or 1614 as overſeer of the ſalt-works at Frankenhauſen in Thuringia. His treatiſe, which Cabeus had in his poſſeſſion, was entitled *Tholden's Haligraphia*, printed at Leipſic in 1603. Another edition, printed at the ſame place in 1613, is mentioned by Draudius; but at preſent I have not been able to find it; and can ſay only from Cabeus and Leupold, that Tholden's hydrometer had a weight ſuſpended to it; and that he ſpeaks of the inſtrument not as a new but a well-known invention, and on that account has deſcribed it only imperfectly.

* Philoſophia experimentalis, ſive Commentaria in Ariſtotelis Meteorolog. lib. ii. textus 26. quæſt. 2. tom. ii. p. 158, b. Inveni hoc inſtrumentum poſitum a quodam Jo. Tholden, in libello Germanice ſcripto de ſale; ſed aut auctor ille non intellexit cauſam et formam inſtrumenti, aut certe occultare voluit, non vulgare, nec publicum facere.

† Mundus ſubterraneus, vol. i. p. 254; and alſo *Phyſiologia Kircheriana*, Amſtelod. 1680. fol. tom. i. p. 29.

Kircher,

Kircher, whoſe works were generally read, ſeems to have principally contributed towards making it publicly known; and Schott *, Sturm † and others, in their account of it, refer to his writings. The artiſts at Nuremberg, who worked in glaſs, and who conſtructed a great many hydrometers which were every where ſold, aſſiſted in this likewiſe. One, above all, made by Michael Sigiſmund Hack, was highly valued about the beginning of the preſent century, as we are told by J. Henry Muller ‡, profeſſor at Altorf. Of this artiſt, often mentioned by Sturm and other philoſophers, an account has been given by Doppelmayr §. He died in 1724.

Many improvements, or perhaps only alterations, have been made in this inſtrument in latter times by a variety of artiſts. The taſk of collecting theſe completely, in chronological order, with explanations, I ſhall leave to others; and only mention a few of them. One of the firſt who endeavoured to adapt the hydrometer for determining the ſpecific gravity and purity of metals was

* Curſus mathemat. p. 455. icon. 20. f. 469.

† Collegii experimentalis pars ſecunda. Norimbergæ 1715. 4to. p. 58.

‡ Diſſertat. de hydrometro. Altorfi 1723. 4to. p. 9.

§ Page 275.

Monconys *. Almoſt about the ſame period Cornelius Mayer and Mr. Boyle ſeem to have conceived the idea of facilitating the weighing of ſolid bodies by a weighing-ſcale added to the inſtrument. The former affirms that this improvement was invented by him ſo early as the year 1668 †; whereas Boyle did not make his known till 1675 ‡. Beſides theſe the following alſo are worthy of notice: Feuille §, Fahrenheit, Clarke ||, and Leutmann **, whoſe improvements have been deſcribed by Wolf††, Leupold ‡‡, Geſner §§, Weigel |||, and others.

* In the third part, p. 3. of the letters printed with his Travels, which addition ſeems to have been made in the year 1664. I quote the edition printed at Lyons 1665 and 1666, three volumes in quarto, *Journal des voyages de Monconys.*

† Nuovi ritrovamenti diviſi in due parte. Roma 1696, fol. I ſhall take this opportunity of obſerving that a good account of Mayer and of his works, which are ſcarce, may be found in *Scheibels Mathematiſche bücherkunde*, ii. p. 443.

‡ Hydroſtatica medica, and in the Philoſoph. tranſact. 1675. N°. cxv. p. 329, where an engraving is given of all the parts, p. 340.

§ Journal des obſervations phyſiques et mathematiques. Paris 1714, 4to. i. p. 16.

|| Philoſoph. tranſact. N°. ccclxxxiv. p. 140; and Numb. ccccxiii. p. 277.

** Commentarii Acad. Petropolit. v. p. 274.

†† In his Verſuchen. Halle 1737, 8vo. i. p. 556.

‡‡ Pars ii. Theatri ſtatici univerſalis, ſive Theatrum hydroſtaticum.

§§ In his Diſſertation mentioned in the firſt note to this article.

||| C. E. Weigel, Programma de hiſtoriæ barylliorum rudimentis. Gryphiæ 1785, 4to.

LIGHTING OF STREETS.

THE lighting of ſtreets, while it greatly contributes to ornament our principal cities, adds conſiderably alſo to the convenience and ſecurity of the inhabitants. But, of whatever benefit it may be, it is generally conſidered as a modern invention. Mr. St. Evremond ſays, "The invention of lighting the ſtreets of Paris, during the night, by a multitude of lamps, deſerves that the moſt diſtant nations ſhould go to ſee what neither the Greeks nor the Romans ever thought of for the police of their republics." This opinion appears to be well founded; for I have never yet met with any information which proves that the ſtreets of Rome were lighted. Some paſſages, indeed, in ancient authors rather indicate the contrary; and, according to my ideas, the Romans would not have conſidered the uſe of flambeaux and lanterns ſo neceſſary, on their return from their nocturnal viſits, as they ſeem to have done, had their ſtreets been lighted; though I will allow that the public lighting of the ſtreets, in our cities, does not render links or lanterns altogether ſuperfluous. Whoever walked the ſtreets of Rome, at night, without a lantern, was under the neceſſity of creeping home in perfect darkneſs, and

in great danger *, like Alexis in Athenæus. Meurſius endeavours to make it appear that the ſtreets of Rome were lighted; and in ſupport of this opinion quotes Ammianus Marcellinus, and the Life of Julius Cæſar in Suetonius; but his arguments to me are far from being convincing †. That Naples was not lighted, appears from the return of Gito in the night-time, mentioned by Petronius ‡. Some circumſtances, however,

* Non multum edens, bibenſque multum, protinus
Diſcedo, lucernam puer nec fert mihi;
Serpo cadens perſæpe per nigras tenebras.
Athen. Deipn. vi. 8. p. 236.

† Joh. Meurſii Opera, ex recenſione Joannis Lami. Florentiæ 1745. fol. v. p. 634.—The paſſages on which Meurſius founds this idea are as follow: Adhibitis paucis clam ferro ſuccinctis, veſperi per tabernas palabatur et compita, quæritando Græco ſermone, cujus erat impendio gnarus, quid de Cæſare quiſque ſentiret; et confidenter agebat in urbe, ubi pernoctantium luminum claritudo dierum ſolet imitari fulgorem. *Ammian. Marcell.* edit. Gronov. Leyden 1693. fol. p. 5. Dein poſt ſolis occaſum, mulis e proximo piſtrino ad vehiculum junctis, occultiſſimum iter modico comitatu ingreſſus eſt; et cum luminibus extinctis deceſſiſſet via, diu errabundus tandem ad lucem duce reperto per anguſtiſſimos tramites pedibus evaſit. *Suet. in Vit. Jul. Cæſ.* cap. xxxi.

‡ Neque fax ulla in præſidio erat, quæ iter aperiret errantibus, nec ſilentium noctis jam mediæ promittebat occurrentium lumen. Accedebat huc ebrietas et imprudentia locorum, etiam interdiu obſcura. Itaque cum hora pene tota per omnes ſcrupos gaſtrorumque eminentium fragmenta traxiſſemus cruentos pedes, tandem expliciti acumine Gitonis ſumus. *Pet.* cap. lxxix. That the

ever, related by ancient authors make it probable that Antioch, Rome and a few other cities had public lanterns, if not in all the ſtreets, at leaſt in thoſe which were moſt frequented.

Libanius, who lived in the beginning of the fourth century, ſays in his Panegyric *, where he praiſes his native city Antioch, "the light of the ſun is ſucceeded by other lights, which are far ſuperior to the lamps lighted by the Egyptians on the feſtival of Minerva of Sais. The night with us differs from the day only in the appearance of the light: with regard to labour and employment every thing goes on well. Some work continually; but others laugh and amuſe themſelves with ſinging." I cannot allow myſelf to imagine that the ſophiſt here conſiders it as a ſubject of praiſe to his native city, that the inhabitants, after ſun-ſet,

the author here ſpeaks of Naples I conclude from cap. lxxxi. where the city is called *Græca urbs*. Others, however, with leſs probability, are of opinion that *Capua* is meant.

* Solis porro facem aliæ faces excipiunt, quæ illam Ægyptiorum (in Minervæ Saiticæ feſto) lucernarum accenſionem longe ſuperant. Hac una re tantum differt nox a die apud nos, nimirum ſpecie lucis: quod ad opificia, certe, et ſtructuras ſpectat, ex æquo procedit. Quidam aſſidue et jugiter operantur manibus; alii vero molle rident et canticum laxantur. Και την ηλιου λαμπαδα λαμπηρες ἑτεροι διαδεχονται την Αιγυπτιων λυχνοκαιαν παριοντες (ſo reads Gronovius inſtead of περιοντες), και διενηνοχεν ενι μονῳ παρ' ἡμιν νυξ ἡμερας, τῳ τα φατος εἰδει. Libanii Opera, Lutetiæ apud Morellum 1627. fol. ii. p. 387.

did not ſit in darkneſs, but uſed lights to work by. It appears, therefore, that he alludes to the lighting of the ſtreets.

In another paſſage, in the oration to Ellebichus *, the ſame author tells us, that the ropes from which the lamps that ornamented the city were ſuſpended, had been cut by ſome riotous ſoldiers, not far from a bath. "Proceeding," ſays he, "to a bath, not far off, they cut with their ſwords the ropes from which were ſuſpended the lamps that afforded light in the night-time, to ſhew that the ornaments of the city ought to give way to them." This quotation indicates, at any rate, that there were lamps ſuſpended from ropes near the baths and places of greateſt reſort. The following paſſage of Jerome, however, ſeems to make it probable, or rather certain, that the ſtreets of Antioch were lighted. In the altercation between a Luciferan and an Orthodox, he relates that an adherent of the ſchiſmatic Lucifer diſputed, in the ſtreet, with a true believer, till the ſtreets were lighted, when the liſtening crowd departed;

* Ελθοντες επι το πλησιαζον βαλανειον, καλωα ων εξηρτηντο τα τω φως εν νυκτι παρεχοντα μαχαιραις απεκοπησαν, δεικνυντες ὁτι δει τον εν τη πολει κοσμον ταις αιτων βουλησεσι υποχωρειν. Profecti ad vicinum balneum, funes a quibus appendebant ea quæ lumen noctu præbebant, gladiis reſciderunt, quoniam oporteret ornatum qui in civitate eſt ſuis conciliabulis cedere. *In Ellebichum*, p. 526.

and

and that they then ſpat in each other's face, and retired *.

In the elegant edition of the works of that father, by Dominicus Vallarſius, we have a ſhort diſſertation on the time when this unmannerly diſpute took place; and the editor ſhews that it happened, at Antioch, in the year 378 †.

Baſilius the Great, in a letter to Martinianus, giving an account of the miſerable ſituation of his native city Cæſarea, in Cappadocia, in the year 371, ſays they had nights without lights (*noctes non illuſtratas* ‡). Moſt commentators explain this paſſage as if it meant that the lamps in the ſtreets had not been lighted ||.

* Dum audientium circulum lumina jam in plateis accenſa ſolverent, et inconditam diſputationem nox interrumperet, conſputa invicem facie receſſerunt.

† See the works of Jerome, *ſtudio et labore Dominici Vallarſii*, Veronæ 1735. fol. vol. ii. p. 170.

‡ Νυκτας αλαμπεις.

|| Valeſius informs us, in his obſervations on Ammianus Marcellinus, that to denote public ſorrow, on occaſions of great misfortune, it was cuſtomary not to light the ſtreets; and in proof of this aſſertion, he quotes a paſſage of Libanius, where it is ſaid that the people of Antioch, in order to mitigate the anger of the emperor, bethought themſelves of lighting either no lamps or a very ſmall number. This paſſage of Libanius I cannot find; but the words of Baſilius are in vol. iii. p. 169 of the excellent edition of that father publiſhed by the Benedictines at Paris, in 1730, in folio.

That the ſtreets not only of Antioch, but alſo of Edeſſa, in Syria, were lighted, in the fifth century, ſeems proved by a paſſage in the Hiſtory of Jeſue Stylites. It is there expreſsly ſaid, that Eulogius, governor of Edeſſa, about the year 505, ordered lamps to be kept burning in the ſtreets during the night; and that he employed, for that purpoſe, a part of the oil which was before given to the churches and monaſteries *.

With regard to the public lighting of whole cities on feſtivals, and particularly on joyful occaſions, which we call illuminations, that practice ſeems to be of great antiquity. Of this kind was a particular feſtival of the Egyptians †, during which lamps were placed before all the houſes throughout the country, and kept burning the whole night ‡. During that feſtival of the Jews,

* Eulogius Edeſſæ præfectus, acceptis ab Anaſtaſio libris auri bis centum, extima urbis propugnacula reſtaurat. Aquæ ductus præterea duos extruit. - - - - Collapſas quoque balneas et prætoris ædes ædificat; aliiſque præterea ædificiis Edeſſam exornat. Petro etiam urbis epiſcopo libras auri viginti Anaſtaſius mittit ad mæniorum inſtaurationem. Urbicius eunuchus decem libras auri adjecit ad excitandum B. Mariæ templum. Solebant Edeſſæ præfecti menſuras olei ſex mille et octingentas templis et monaſteriis diſtribuere. Eulogius vix ducentas ſingulis templis erogari juſſit, reliquas ad publicum urbis uſum recondi; inſtituitque, ut in porticibus noctu lampades arderent. *Aſſemani Bibliotheca orientalis.* Romæ 1719. fol. i. p. 281.

† It was called by the Greeks λυχνοκαΐα.

‡ Herodot. lib. ii. cap. 62.

called

called *feſtum encæniorum*, the feaſt of the Dedication of the Temple, which, according to common opinion, was celebrated in December, and continued eight days, a number of lamps were lighted before each of their houſes *. A paſſage in Æſchylus ſhews that ſuch illuminations were uſed alſo in Greece. At Rome, the forum was lighted when games were exhibited in the night-time †; and Caligula, on a like occaſion, cauſed the whole city to be lighted ‡. As Cicero was returning home late at night, after Catiline's conſpiracy had been defeated, lamps and torches were lighted in all the ſtreets, in honour of that great orator ||. The emperor Conſtantine cauſed the whole city of Conſtantinople to be illuminated with lamps and wax candles on Eaſter eve §. The fathers of the firſt

* Et accendere mos eſt in eis lumina tempore veſpertino, ad oſtium domorum. *Gemara Babylonica*, ad tit. *Sabbath.* c. ii. p. 21.

† Romanis ludis forum olim ornatum lucernis. *Nonius*, p. 206.

‡ Scenicos ludos et aſſidue et varii generis multifariam fecit; quondam etiam et nocturnos accenſis tota urbe luminibus. *Suet. Vita Calig.* c. 18.

|| Plut. in Vita Ciceronis.

§ Sacram autem vigiliam in diurnum ſplendorem convertebat, accenſis tota urbe cereorum quibuſdam columnis per eos quibus id operis erat injunctum. Lampades quoque accenſæ cuncta paſſim loca illuſtrabant, adeo ut hæc myſtica vigilia quovis vel ſplendidiſſimo die ſplendidior redderetur. *Euſeb. Pamphili. Lib.* iv. *de vita Conſtantini*, cap. 22. Cant. 1720. fol. p. 637. Compare

firſt century frequently inveigh againſt the Chriſtians becauſe, to pleaſe the heathens, they often illuminated their houſes, on idolatrous feſtivals, in a more elegant manner than they. This they conſidered as a ſpecies of idolatry *. That the houſes of the ancients were illuminated on birth-days, by ſuſpending lamps from chains, is too well known to require any proof †.

Of modern cities, Paris, as far as I have been able to learn, was the firſt that followed the example of the ancients by lighting its ſtreets. As

pare with the above *Greg. Nazianzeni Orat.* 19, and *Orat.* 2. p. 676, where the author alludes to the feſtival of Eaſter. I imagined that I ſhould meet with ſome orders reſpecting illuminations in Conſtantine's book *De ceremoniis aulæ Byzantinæ*; but I was not ſo fortunate as to find any. Reiſke ſays, in his Annotations, p. 93. a: De illuminationibus et ignibus artificialibus veterum annotavi quædam ad p. 351, ubi de hilariis triumphalibus egi; but theſe notes were unfortunately never printed.

* Plures jam invenies ethnicorum fores ſine lucernis et laureis quam Chriſtianorum. *Tertullian. De idololatria*, cap. xv. p. 523. See alſo his *Apologet.* cap. 35. p. 178. In both places La Cerda quotes ſimilar paſſages from other writers. In *Concilio Eliberitano*, cap. 37, it was decreed *prohibendum etiam ne lucernas publice accendant.* See alſo *Joh. Ciampini Vetera monumenta, in quibus muſiva opera illuſtrantur.* Romæ 1690. 2 vol. fol. i. p. 90. where, on a piece of moſaic work, ſaid to be of the fifth century, ſome lamps are repreſented hanging over a door.

† *J. Lipſii Electa*, lib. ii. cap. 3, in the edition of his works Antwerp 1637, 3 vol. fol. p. 234. *Kippingii Antiquit. Rom.* Lugd. Bat. 1713. 8vo. p. 189.

this

this city, in the beginning of the ſixteenth century, was much infeſted with ſtreet robbers and incendiaries, the inhabitants were, from time to time, ordered to keep lights burning, after nine in the evening, before the windows of all the houſes which fronted the ſtreet. This order was iſſued in the year 1524, and renewed in 1526 and 1553*; but in the month of October 1558, *fallots* were erected at the corners of the ſtreets, or, when the ſtreet was ſo long that it could not be lighted by one, three were erected in three different parts of it. Theſe lights had, in a certain meaſure, a reſemblance to thoſe uſed in ſome mines; for we are told, in the *Grand Vocabulaire, François* †, that *Falot* is a large vaſe filled with pitch, roſin and other combuſtibles, employed in the king's palace and houſes of princes to light the courts. At that period there were in Paris 912 ſtreets; ſo that the number of lights then uſed muſt have been leſs than 2736 ‡.

In the month of November, the ſame year,

* This order may be ſeen in that large and elegant work, entitled, *Hiſtoire de la Ville de Paris, compoſée par D. Michel Felibien, reveue, augmentée et miſe à jour par D. Guy-Alexis Lobineau*, Paris 1725. Five large volumes in folio, with many plates. See vol. ii. pp. 951, 977, and vol. iv. pp. 648, 676, 764.

† Paris 1770. x. p. 265.

‡ Felibien, iv. p. 785.

theſe

theſe lights were changed for lanterns of the like kind as thoſe uſed at preſent *. The lighting of the ſtreets of Paris continued, however, for a long time to be very imperfect, till the abbé Laudati, an Italian of the Caraffa family, conceived the idea of letting out torches and lanterns for hire. In the month of March 1662, he obtained an excluſive privilege to this eſtabliſhment for twenty years; and he undertook to erect, at certain places, not only in Paris, but alſo in other cities of the kingdom, booths or poſts where any perſon might hire a link or lantern, or, on paying a certain ſum, might be attended through the ſtreets by a man bearing a light. He was authoriſed to receive from every one who hired a lantern to a coach, five ſous, for a quarter of an hour; and from every foot-paſſenger three ſous. To prevent all diſputes in regard to time, it was ordered that a regulated hour-glaſs ſhould be carried along with each lantern †.

In 1667, however, the lighting of the city of Paris was put on that footing on which it is at preſent. At the ſame time the police was greatly improved, and it afterwards ſerved as a pattern to

* Felibien, iv. p. 786. The order ſays: que au lieu des fallots ardens ſeront miſes lanternes ardentes et allumantes. - - -

† Felibien, v. p. 191, where the order may be ſeen in which *porte-lanternes* and *porte flambeaux à louage* are mentioned.

moſt

moſt of the other cities in Europe. Affairs of judicature and thoſe reſpecting the public police, inſtead of being committed, as before, to one magiſtrate, called the *Lieutenant civil du prevoſt de Paris*, were by a royal edict, of the month of March in the above year, divided between two perſons. One of them, who had the management of judicial affairs, retained the old title; and the other, who ſuperintended the police, had that of *Lieutenant du prevoſt de Paris pour la police*, or *Lieutenant général de police*. The firſt lieutenant of police was Nicholas de Reynie, a man who, according to the praiſes beſtowed on him by French writers, formed an epoch in the hiſtory of modern police. In the Hiſtory of Paris, ſo often already quoted, he is called an enlightened, upright and vigilant magiſtrate, as zealous for the ſervice of the king as for the good of the public, and who ſucceeded ſo well in this new office that we may ſay, adds the author, it is to him, more than to any other, that we are indebted for the good order which prevails at preſent in Paris. The firſt uſeful regulation by which La Reynie rendered a ſervice to the police, was that for improving the *(guet)* night watch, and the lighting of the ſtreets *. I can find no complete account of the changes he introduced; but four years after, that

* See Code de la Police, par M. D. troiſieme edit. Paris 1761. 8vo. t. i. p. 228.

is, on the 23d of May, 1671 *, an order was made that the lanterns every year ſhould be lighted from the 20th of October till the end of March in the year following, and even during moon-light; becauſe the latter was of little uſe in bad weather, and even in fine weather was not ſufficient to light ſome of the moſt dangerous ſtreets.

Before this period the ſtreets were lighted only during the four winter months; and on account of the numberleſs atrocities committed in the night-time, when there were no lights, the Pariſians offered to contribute as much money as ſhould be ſufficient to defray the expence of keeping the lamps lighted throughout the whole winter. The lamps employed by La Reynie were, on account of their likeneſs to a bucket, called *lanternes à ſeau* †, and ſucceeded thoſe invented by one Herault, called *lanternes à cul-de-lampe*.

When De Sartines held the office of *Lieutenant de police*, a premium was offered to whoever ſhould diſcover the moſt advantageous means of improving the lighting of the ſtreets; and the Academy of Sciences were to decide on the dif-

* Felibien, t. v. p. 213.

† Die kunſt auf glas zu malen und glasarbeiten zu verfertigen; von LeVieil. Aus dem Franzöſ. überſetzt. Nürnberg 1780. 4to. iii. p. 77.

ferent

ferent plans that might be propoſed. In conſequence of this offer a journeyman glazier, named Goujon, received a premium of 200 livres, and Meſſrs. Bailly, le Roy, and Bourgeois de Chateaublanc 2000 livres. To the laſt-mentioned gentleman is aſcribed the invention of the preſent reverberating lamps, deſcribed by La Vieil, which were introduced in 1766 *.

In a ſmall work, called an Eſſay on Lanterns, by a ſociety of literary men †, which, though written to ridicule antiquarian reſearches, and certain perſons at Paris, contains ſome authentic information reſpecting the lighting of the ſtreets, we are told that reverberating lamps were invented by an abbé P. who, therefore, ſays the author humouroufly, is the ſecond abbé who can boaſt of having enlightened the firſt city in the world. The ſuperiority of theſe lamps cannot be denied; but, beſides their expence, they are attended with this diſadvantage when they hang in the middle of the ſtreet, that they throw a ſhade over it, ſo that one cannot be known by thoſe who paſs. In cities alſo where people walk principally in the middle of the ſtreets, or where the ſtreets are broad, they are not very convenient, and they oc-

* Dictionnaire des origines, vi. p. 34.

† Eſſai ſur les Lanternes, par une ſocieté de gens de lettres. A Dole 1755.

caſion

caſion a ſtoppage when it is neceſſary to clean them.

In the year 1721, the lamps in Paris are ſaid to have amounted to 5772; but in the *Tableau de Paris*, printed in 1760, the number is reckoned to be only 5694, and in the *Curioſités de Paris*, 1771, they are ſtated to be 6232.

In 1777 the road between Paris and Verſailles, which is about nine miles in length, was lighted at the yearly expence of 15000 livres by the ſame contractors who lighted Paris. The city of Nantes was lighted the ſame year; and in 1780 had 500 lamps. Straſburgh began to be lighted in 1779.

If what Maitland ſays in his hiſtory * be true, that in the year 1414 an order was iſſued for hanging out lanterns to light the ſtreets, and if that regulation was continued after the above period, which I very much doubt, then muſt it be allowed that London preceded Paris in this uſeful eſtabliſhment. Maitland refers for his authority to Stow's Survey of London; but in the edition of that work publiſhed in 1633, I find only, where a liſt of the magiſtrates is given, the following information: "1417 Major, Sir Henry Barton, ſkinner. This Henry Barton ordained lan-

* Hiſtory of London. London 1756. 2 vol. fol. i. p. 186.

thorns

thorns with lights, to bee hanged out on the winter evenings, betwixt Hallontide and Candlemaſſe." Nothing more occurs in the new edition of Strype, publiſhed in 1720.

In the year 1668, when ſeveral regulations were made for improving the ſtreets, the Londoners were reminded that they ſhould hang out lanterns duly at the accuſtomed time*. In the year 1690 this order was renewed, and every houſekeeper was required to hang out a light or lamp, every night, as ſoon as it was dark, between Michaelmas and Lady-day; and to keep it burning till the hour of twelve at night. In the year 1716 it was ordained by an act of common council, that all houſe-keepers, whoſe houſes fronted any ſtreet, lane, or public paſſage, ſhould, in every dark night, that is, every night between the ſecond night after every full moon, and the ſeventh night after every new moon, ſet or hang out one or more lights, with ſufficient cotton wicks, that ſhould continue to burn from ſix o'clock at night till eleven o'clock of the ſame night, under the penalty of one ſhilling. All theſe regulations, however, ſeem to have been ineffectual, owing to bad management. The city

* New Hiſtory of London, by John Noorthouck. Lond. 1773. 4to. p. 233: For the ſafety and peace of the city, all inhabitants were ordered to hang out candles duly at the accuſtomed hour.

was lighted by contract, and the contractors for liberty to light it were obliged to pay annually to the city the ſum of ſix hundred pounds. Beſides, the contractors received only ſix ſhillings per annum from every houſe-keeper whoſe rent exceeded ten pounds; and all perſons who hung out a lantern and candle before their houſes were exempted from paying towards the public lamps. The ſtreets were lighted no more than one hundred and ſeventeen nights; and as this gave great opportunity to thieves and robbers to commit depredations in the night-time, the lord mayor and common council judged it proper, in the year 1736, to apply to parliament for power to enable them to light the ſtreets of the city in a better manner; and an act was accordingly paſſed, by which they were empowered to erect a ſufficient number of ſuch ſort of glaſs lamps as they ſhould judge proper, and to keep them burning from the ſetting to the riſing of the ſun throughout the year*. Inſtead, therefore, of a thouſand lamps, the number was now increaſed to 4679; but as theſe even were not ſufficient, ſeveral of the wards made a conſiderable augmentation, ſo that the whole could amount to no leſs than 5000. This, however, was not the amount of all the lamps in London, but of thoſe in what is properly called the city and liberties. As this

* Maitland, i. p. 566.

diviſion

diviſion forms only a fifth part of London, Maitland reckons the whole number of public and private lamps to have been, even at that period, upwards of fifteen thouſand. The time of lighting alſo, which before had been only 750 hours annually, was increaſed to five thouſand. In our cities of Lower Saxony, the ſtreets of which are not ſo dark as thoſe of London, the lighting continues 1519 hours.

In the year 1744, owing to the great number of robberies committed in the ſtreets during the night, it was found neceſſary to apply for another act of parliament to regulate ſtill farther the lighting of the city *; and at that period this eſtabliſhment was placed upon that footing on which it now ſtands.

The lamps of London, at preſent, are all of cryſtal glaſs; each is furniſhed with three wicks; and they are affixed to poſts placed at the diſtance of a certain number of paces from each other. They are lighted every day in the year at ſun-ſet. Oxford-ſtreet alone is ſaid to contain more lamps than all Paris. The roads, even, ſeven or eight miles round London are lighted by ſuch lamps; and as theſe roads from the city to different parts are very numerous, the lamps ſeen from a little

* Maitland, i. p. 640.

diſtance, particularly in the county of Surrey, where a great many roads croſs each other, have a beautiful and noble effect *. Birmingham was lighted, for the firſt time, in 1733, with 700 lamps †.

It appears that the ſtreets of Amſterdam were lighted by lanterns ſo early as 1669; for in the month of February that year, the magiſtrates, who in 1665 had forbidden the uſe of torches, iſſued an order againſt deſtroying the lamp-poſts, to which it was cuſtomary to faſten horſes ‡. This order, as well as the inſtructions given to the lamp-lighters in 1669, may be found in a work called the Privileges of the city of Amſterdam. The lanterns were not of glaſs, but of horn; for the lamp-lighters were ordered, in their inſtructions, to wipe off every day the ſmoke of the train-oil which adhered to the horn of the lanterns.

At the Hague an order was iſſued in the month of October 1553, that the inhabitants ſhould place

* The above account is taken from Mr. Archenholz (*England und Italien*. Leipzig 1785, 8vo. i. p. 141); but the information of this author, on account of his great partiality for England, is very doubtful. Compare *Nouvelles obſervations ſur l'Angleterre, par un voyageur*; Paris 1779: though the author of this work alſo is not conſidered as altogether free from the ſame fault.

† Hutton's Hiſtory of Birmingham, 1781, 8vo. p. 99.

‡ Handveſten of te privilegien end octroyen de Stad Amſtelredam. Te Amſtelredam 1748, fol. ii. p. 1047.

lights before their doors during dark nights; and afterwards ſmall ſtone houſes were erected at the corners of the principal ſtreets, in which lights were kept burning; but in the year 1678 lamps were fixed up in all the ſtreets *.

The ſtreets of Copenhagen were firſt lighted by lamps in 1681; and on the 16th of July 1683, new regulations were made, by which the plan was much improved, as well as that of the night-watch †.

The ſtreets of Rome are not yet lighted. Sixtus V was deſirous to introduce this improvement in the police, but he met with inſurmountable obſtacles. In order however that the benefit of lighting might be enjoyed in ſome meaſure, he ordered the number of the lights placed before the images of ſaints to be augmented ‡. De la Lande ſays, in his Travels, that Venice had been lighted for ſome years before the period when he wrote, by 3000 lamps ||. Meſſina §, and Palermo ¶, in Sicily, are both lighted.

* Beſchryving van ſ'Graven-Hage; door Jacob de Riemer. In ſ'Graven-Hage 1739, fol. ii. p. 265.

† Mr. Gebhardi in Algemeine welthiſtorie, xxxiii. p. 596.

‡ Lettres écrites de Suiſſe, d'Italie, de Sicile et de Malthe; en 1776—78.

|| Voyage d'un François par Italie, tom. viii. p. 187.

§ Lettere del ſignor abate Domenico Seſtini, ſcritte dalla Sicilia e dalla Turchia. In Firenze. Four vol. 12mo. vol. i. 216.

¶ Riedeſels Reiſe durch Sicilien und Griechenland. Zurich 1771, 8vo.

Madrid, which till lately was the dirtieſt of all the capital cities of Europe, is at preſent as well lighted as London *. Valencia in Spain was ſome years ago indebted for this improvement to Joachim Manuel Fos, then inſpector of the manufactories †. Barcelona is lighted alſo ‡. Liſbon however has no lights.

The ſtreets of Philadelphia are lighted, and on each ſide there is a foot-pavement ||.

In the year 1672, the council of Hamburgh made a propoſal to the citizens for lighting the ſtreets. The year following this propoſal was accepted, but the lamps were not fixed up till two years after, that is to ſay in 1675 §.

In the year 1679, Berlin had advanced ſo far towards this improvement, that the inhabitants were

* See Twiſs and Dalrymple's Travels.

† Ueber Sitten, temperament, alterthümer und die gerichtshöfe Spaniens. Aus dem Franzöſiſchen. Leipz. 1781, 2 vol. 8vo. i. p. 86.

‡ Travels through Spain, by Henry Swinburne. London 1779, 4to.

|| Burnaby's Travels through North America.

§ Von Grieſheims Anmerkungen über den tractat, die Stadt Hamburg, p. 223. *Nucleus receſſuum et conventuum Hamburgenſium*; Altona 1705, fol. art. *Lighting*. *Sammlung der Hamburgiſchen mandate, befehle u. ſ. w.* vol. i. p. 321, and ii. p. 584; where may be found the rigid inſtructions given to the lamp-lighters and thoſe who had the care of the lamps.

obliged

obliged in turns to hang out a lantern with a light at every third houſe. In 1682, the elector Frederick William cauſed lamp-poſts with lamps to be erected, notwithſtanding the oppoſition made by the inhabitants on account of the expence. In a petition which they preſented in 1680, they ſtated that the lamps coſt 5000 dollars, and that 3000 were required yearly to keep them lighted. At preſent Berlin has 2354 lamps, which are kept lighted from September till May, and at the king's expence. Potſdam has 590 *.

Vienna began to be lighted in the year 1687. The lights were hung out in the evening on a ſignal given by the fire-bell †. In 1704, lamps were introduced; but at firſt the light which they afforded was very imperfect, as the lamps burned badly, and becauſe, to ſave the expence of lamp-lighters, every houſekeeper was obliged daily to remove the empty lamps, to carry them to the lamp-office to be filled, and to light them again on a ſignal given with a bell. In 1776, the lamps, which before amounted to 2000, were increaſed to 3000, and a contract was entered into for lighting them at the rate of 30,000 florins. Theſe lamps were invented by counſellor Sonnenfels, and amount now to

* Nicolai Berſchreibung von Berlin und Potſdam, p. 308, 971.

† Codex Auſtriacus. Vienna 1704, fol. p. 514; and Supplement, i. p. 993.

3445 *. They are made of white glaſs, in a globular form, and have a covering of tin plate, painted red on the outſide and poliſhed within. They are ſupported by lamp-irons, fixed in the houſes at the height of fifteen feet from the earth. Each lantern is only ſixteen paces diſtant from the other, ſo that the ſtreets are completely illuminated. They are kept lighted both ſummer and winter, whether the moon ſhines or not; and this is more neceſſary at Vienna than any where elſe, on account of the height of the houſes and the narrowneſs and crookedneſs of the ſtreets. The lamp-lighters wear an uniform, and are under military diſcipline. In 1783, the yearly expence of the lamps was eſtimated at only 17,000 florins †.

Leipzig was lighted in 1702, and Dreſden in 1705 ‡. In 1766, the number of lamps at the latter amounted only to 728, for the lighting of which oil of rape-ſeed was employed.

In Caſſel the ſtreets began to be lighted under the landgrave Charles, in 1721; but as regulations were not made ſufficient to ſupport this improvement, it was at length dropped. It was however

* Neueſte beſchreibung aller merkwürdigkeiten Wiens. Wien 1779, 8vo. p. 14.

† Nicolai Beſchreibung einer reiſe, iii. p. 212, 214.

‡ The regulations may be found in *Codex Auguſteus*, i. p. 1721, 1727. See alſo *Schmieders Policey von Sachſen*, p. 315.

revived

revived in 1748 *, and in 1778 the number of the lamps was increaſed to 1013, beſides thoſe at the landgrave's palace.

Hanover was lighted in 1696†, Halle in 1728‡, and Gottingen in 1735. Brunſwick ſince 1765 has had 1565 lamps ||. Zurich has been lighted ſince 1778, but the lamps are very few in number §.

NIGHT-WATCH.

THE eſtabliſhment of thoſe people who are obliged to keep watch in the ſtreets of cities during the night, belongs to the oldeſt regulations of police. Such watchmen are mentioned in the Song of Solomon, and they occur alſo in the book of

* Schminke, Beſchreibung der reſidenz-ſtadt Caſſel, 1767, 8vo. p. 329.

† Du Plat, Situations-riſſe der chauſſeen des Churfürſtenth. Brunſchw. Luneb. Hannover 1780, 4to. i. p. 71.

‡ Von Dreyhaupts Beſchreibung des Saalkreiſes, ii. p. 379.

|| Brunſchw. Intelligenz-Blatt, 1785. *Handbuch für kaufleute*, 1784, p. 18.

§ Anth. Werdmuller, Memorabilia Tigurina, oder Merkwürdigkeiten der Stadt Zürich. 1780, 4to. i. p. 350.

Pſalms.

Pſalms *. Athens, and other cities of Greece, had at leaſt ſentinels poſted in various parts; and ſome of the *theſmothetæ* were obliged to viſit them from time to time, in order to keep them to their duty †. At Rome there were *triumviri nocturni*, *cohortes vigilum*, &c. ‡

The object of all theſe inſtitutions ſeems to have been rather the prevention of fires than the guard-

* The watchmen that go about the city found me: to whom I ſaid, Saw ye him whom my ſoul loveth? *Song of Solomon*, chap. iii. ver. 3. The watchmen that went about the city found me, they ſmote me, they wounded me; the keepers of the walls took away my veil. *Ibid.* chap. v. ver. 7. Except the Lord build the houſe, they labour in vain that build it: except the Lord keep the city, the watchman watcheth but in vain. *Pſalm* cxxvii. ver. 1.

† They were called κωδωνοφοροι bell-bearers or bellmen, becauſe, while going the rounds, they gave a ſignal with their bells, which the ſentinels were obliged immediately to anſwer. See the Scholiaſts on the *Aves* of Ariſtophanes, ver. 841, whoſe words have been inſerted by Varinus in his Dictionnary, p. 461. To the ſame claſs belong the περιπολοι την πολιν φυλαττοντες in Pollux, viii. cap. 9, 105, where ſome however read χωραν. Dio Caſſius, lib. liv. 4. p. 733, ſays: The watchmen in the different quarters of the city have ſmall bells, that they may make ſignals to each other when they think proper. Οι τας συνοικιας νυκτωρ φυλασσοντες, κωδωνοφορουσιν, ὑπως σημαινειν σφισιν ὁποταν βουληθωσι δυνωνται. The bells therefore did not ſerve for announcing the hours, as ſome have imagined.

‡ See *Cruſii Comment. de nocte*, cap. 5, in *Sallengre, Theſaur. antiq.* ii. p. 836, and *C. Ch. Heubach, Comment. de politia Romanorum.* Gottingæ 1791, 4to. p. 54, 72.

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ing againſt nocturnal alarms or danger; though in the courſe of time attention was paid to theſe alſo. When Auguſtus wiſhed to ſtrengthen the night-watch, for the purpoſe of ſuppreſſing nocturnal commotions, he uſed as a pretext the apprehenſion of fires only *. The regulations reſpecting theſe watchmen, and the diſcipline to which they were ſubjected, were almoſt the ſame as thoſe for night-ſentinels in camps during the time of war; but it does not appear that the night-watchmen in cities were obliged to prove their preſence and vigilance by ſinging, calling out, or by any other means. Signals were made by the patroles alone, with bells, when the watchmen wiſhed to ſay any thing to each other. Singing by ſentinels, in time of war, was cuſtomary, at leaſt among ſome nations; but in all probability that practice was not common in the time of peace †.

Calling out the hours ſeems to have been firſt practiſed after the erection of city gates, and, in

* We read in Caſſiodorus the orders given to a *præfectus vigilum* on his appointment. It was ſaid to him: Eris ſecuritas ſoporantium, munimen domorum, tutela clauſtrorum, diſcuſſor obſcurus, arbiter ſilentioſus, cui fallere inſidiantes fas eſt, et decipere gloria. *Var.* vii. 7.

† The Perſian ſentinels ſung in this manner when they were ſurpriſed in the city by the Romans. *Ammianus Marcell.* xxiv. 15: Obtruncarunt vigiles omnes, ex uſu moris gentici juſtitiam felicitatemque regis ſui canoris vocibus extollentes.—We read the ſame account in *Zoſimus*, iii. 22. p. 308.

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my opinion, to have taken its riſe in Germany; though indeed it muſt be allowed that ſuch a regulation would have been very uſeful in ancient Rome, where there were no clocks, and where people had nothing in their houſes to announce the hours in the night-time. During the day, people could know the hours after water-clocks had been conſtructed at the public expence, and placed in open buildings erected in various parts of the city. The caſe ſeems to have been the ſame in Greece; and rich families kept particular ſervants, both male and female, whoſe buſineſs it was to announce to their maſters and miſtreſſes certain periods of the day, as pointed out by the city clocks. Theſe ſervants conſiſted principally of boys and young girls, the latter being deſtined to attend on the ladies. It appears however, that in the courſe of time water-clocks were kept alſo in the palaces of the great: at any rate Trimalchio, the celebrated voluptuary, mentioned in Petronius, had one in his dining-room, and a ſervant ſtationed near it to proclaim the progreſs of the hours, that his maſter might know how much of his lifetime was ſpent; for he did not wiſh to loſe a ſingle moment without enjoying pleaſure *.

I have not read every thing that has been writ-

* Trimalchio, lautiſſimus homo, horologium in triclinio, et buccinatorem habet ſubornatum, uti ſubinde ſciat, quantum de vita perdiderit. *Cap.* xxvi. p. 62.

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ten by others on the diviſion of time among the ancients; but after the reſearches I have made, I muſt confeſs that I do not know whether the hours were announced in the night-time to thoſe who wiſhed and had occaſion to know them. There were then no clocks which ſtruck the hours, as has been already ſaid; and as water-clocks were both ſcarce and expenſive, they could not be procured by labouring people, to whom it was of moſt importance to be acquainted with the progreſs of time *. It would therefore have been an uſeful and neceſſary regulation to have cauſed the watchmen in the ſtreets to proclaim the hours, which they could have known from the public water-clocks, by blowing a horn, or by calling out.

It appears however, that people muſt have been ſoon led to ſuch an inſtitution, becauſe the above methods had been long practiſed in war. The periods for mounting guard were determined by water-clocks; at each watch a horn was blown, and every one could by this ſignal know the hour of

* That the ſervants in many houſes were wakened by the ringing of a bell, appears from what Lucian ſays in his treatiſe, *De iis qui mercede conducti in divitum familiis vivunt*, cap. xxiv. p. 245, and cap. xxxi. p. 254, edition of Deux-Ponts, vol. iii. ὑπο κωδωνι εξαναστας, ad tintinnabuli ſonum ſurgens. It does not however follow, that there were then ſtriking or alarm-clocks, as ſome have thence concluded. See *Magius De tintinnabulis*, cap. 6, in *Sallengre, Theſaurus antiquit.* ii. p. 1177.

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the night *; but I have met with no proof that theſe regulations were eſtabliſhed in cities during the time of peace, though many modern writers have

* Vegetius De re milit. iii. 8: In quatuor partes ad clepſydram ſunt diviſæ vigiliæ, ut non amplius quam tribus horis nocturnis neceſſe ſit vigilare. That Cæſar had ſuch clocks, may be concluded from the obſervation which he makes in his Commentaries on the length of the day in the iſlands near Ireland: Nos nihil de eo percunctationibus reperiebamus, niſi certis ex aqua menſuris, breviores eſſe noctes, quam in continente, videbamus. Maternus, in *Römiſche alterthümer*, iii. p. 47, endeavours to prove by what Suetonius relates of Domitian, cap. 16, that this prince had in his palace neither a ſun-dial nor a water-clock. But what kind of a proof! Domitian aſked what the hour was, and ſome one anſwered, the ſixth. Such inſignificant *dicta probantia* have been baniſhed from philoſophy by the moderns, and ought they not to be baniſhed from antiquities likewiſe? The often-quoted paſſage alſo of *Valerius Maximus*, viii. 7, 5, proves nothing, unleſs we firſt adopt the amendment of Green. Carneades, it is ſaid, was ſo engaged in the ſtudy of philoſophy, that he would have forgot his meals had not Meliſſa put him in mind of them. Green reads *monitrix domeſtica;* but Valerius ſays *Meliſſa, quam uxoris loco habebat.* See *Greenii Lib. de ruſticat. Roman.* cap. 9, in *Sallengre, Theſaurus antiq. Rom.* i. p. 721. A paſſage likewiſe in Pliny's Epiſtles, iii. 1. p. 181: *Ubi hora balinei nunciata eſt*, does not properly prove that it alludes to one of thoſe boys who announced the hours. That ſuch ſervants however were kept, is evident from the undoubted teſtimony of various authors. *Martial*, viii. ep. 67: Horas quinque puer nondum tibi nunciat. *Juven. Sat.* x. 216. *Seneca De brevit. vitæ*, c. 12. *Alciphron, Epiſt.* lib. iii. p. 282: Theocares non prius occupat torum, niſi ei ſervus accurrens indicat ſextam eſſe. Still ſtronger is a paſſage of *Sidon. Apollin.* ii. ep. 9. p. 120: Ecce et ab archimagiro adventans, qui tempus inſtare curandi corpora commoneret. Quem quidem nuncium per ſpatia clepſydrarum horarum

have not hesitated to refer to the night-watch in cities what alludes only to nocturnal guards in the time of war *. On the contrary, I am still more strongly inclined to think, that ancient Rome was entirely destitute of such a police establishment. The bells borne by the night watchmen were used only by the patroles, as we are expressly told, or to give signals upon extraordinary occasions, such as that of a fire, or when any violence had been committed. Cicero, comparing the life of a civil with that of a military officer, says, "The former is awaked by the crowing of the cock, and the latter by the sound of the trumpet." The former therefore had no other means of knowing the hours of the night but by attending to the noise made by that animal †. An ancient poet says,

horarum incrementa servantem probabat competenter. A passage in the thirteenth epistle of the same book, p. 138, belongs also to this subject: Cujus spatia vitæ sic custodiebantur, ut per horarum dispositas clepsydras explicarentur. That there were maid-servants for announcing the hours is proved by Hesychius: περιπτρια ἡ παραγγελλουσα την ὡραν ταις τεκτημεναις.

* To night-watching in the time of war the following passages allude: *Propert.* iv. 4. 62: Et jam quarta canit venturam buccina lucem. *Silius Ital.* vii. 155: Mediam somni cum buccina noctem divideret. *Livius*, vii. 35. p. 609. Ubi secundæ vigiliæ buccina datum signum esset. *Seneca, Thyest.* v. 798: Tertia misit buccina signum.

† Vigilas tu de nocte, ut tuis consultoribus respondeas; ille ut eo, quo intendit, mature cum exercitu perveniat. Te gallorum, illum buccinarum cantus excitat. *Cic. Orat. pro Murana*, cap. 22.

that the cock is the trumpeter which awakens people in the time of peace *. The ancients indeed underſtood much better than the vulgar at preſent, who are already too much accuſtomed to clocks, how to determine the periods of the night by obſerving the ſtars; but here I am ſpeaking of capital cities, and in theſe people are not very fond of quitting their beds to look at the ſtars, which are not always to be ſeen.

Without entering into farther reſearches reſpecting watchmen among the ancient Greeks and Romans, I ſhall prove, by ſuch teſtimonies as I am acquainted with, that the police eſtabliſhment of which I ſpeak, is more modern in our cities than one might ſuppoſe. But I muſt except Paris; for it appears that night-watching was eſtabliſhed there, as at Rome, in the commencement of its monarchy. De la Mare † quotes the ordinances on this ſubject of Clothaire II, in the year 595, of Charlemagne, and of the following periods. At firſt the citizens were obliged to keep watch in turns, under the command of a *miles gueti*, who was called alſo *chevalier*. The French writers remark on this circumſtance, that the term *guet*, which occurs in

* Heinſius ſays in his annotations to *Sil. Ital.* vii. 155: Hanc tubam (gallicinium) intelligit in Fragmentis Lyricorum poeta ille, qui pacis tempore gallum ſolam tubam eſſe ait. That paſſage however I have not been able to find.

† Traité de la police, vol. i. in the Index under the word *Guet*.

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the oldeſt ordinances, was formed from the German words *wache*, *wacht*, the guard, or watch; and in like manner ſeveral other ancient German military terms, ſuch as *bivouac*, *landſquenet*, &c. * have been retained in the French language. In the courſe of time, when general tranquillity prevailed, a cuſtom was gradually introduced of avoiding the duty of watching by paying a certain ſum of money, until at length permanent *compagnies de guet* were eſtabliſhed in Paris, Lyons, Orleans, and afterwards in other cities.

If I am not miſtaken, the eſtabliſhment of ſingle watchmen, who go through the ſtreets and call out the hours, is peculiar to Germany, and was copied only in modern times by our neighbours. The antiquity of it however I will not venture to determine. At Berlin, the elector John George appointed watchmen in the year 1583 †; but in 1677 there were none in that capital, and the city officers were obliged to call out the hours ‡. Montagne, during his travels in 1580, thought the calling out of the night-watch in the German cities a very

* *Bivouac*, from the German *beiwacht*, is an additional night-guard during a ſiege, or when an army is encamped near the enemy. *Lanſquenets* were German ſoldiers added by Charles VIII of France to his infantry, and who were continued in the French army till Francis I introduced his legions. TRANS.

† Nicolai Beſchreibung von Berlin, i. p. 38.

‡ Ibid. p. 49.

ſingular cuſtom. "The watchmen," ſays he, "went about the houſes in the night-time, not ſo much on account of thieves as on account of fires and other alarms. When the clocks ſtruck, the one was obliged to call out aloud to the other, and to aſk what it was o'clock, and then to wiſh him a good night *." This circumſtance he remarks alſo when ſpeaking of Inſpruck. Mabillon likewiſe, who made a literary tour through Germany, deſcribes calling out the hours as a practice altogether peculiar to that country †.

The horn of our watchmen ſeems to be the *buccina* of the ancients, which, as we know, was at firſt an ox's horn, though it was afterwards made of metal ‡. Rattles, which are moſt proper for

* Reiſen. Halle 1777, 2 vol. 8vo. i. p. 172 and 237.

† Muræ primum obſervavimus, quod in omnibus ferme Germaniæ locis obſervatur, ut unus famulorum propter incendii periculum noctu excubias agat, et ſingulis ab ignitegio horis, id eſt ab hora octava in hyeme, nona in æſtate, quædam verba variis in locis proclamet, ut ſe vigilem probet. Audite quid dicturus ſim, inquit ille in æſtate hora nona, inſonat hora nona, extinguite lumen et ignem, ut nos Deus cum Maria tutetur. In aliis horis ſignificat, talem inſonuiſſe horam. Id fit, inquam, propter incendii periculum, quod in Germaniæ partibus maximum eſt, quoniam abietinis lignis fere omnia conſtant, ut etiam in pleriſque locis pro tegulis ſunt aſſeres abiegni. *Iter Germanicum.* Hamburgi 1717, 8vo. p. 26.

‡ Lipſius De milit. Rom. iv. 10. p. 198. *Bochart. Hierozoic.* i. p. 317 and 426.

cities,

cities, as horns are for villages, ſeem to be of later invention *. The common form, "Hear, my maſters, and let me tell you," is very old. I am not the only perſon to whom this queſtion has occurred, why it ſhould not rather be "Ye people or citizens." The chancellor von Ludwig deduces it from the Romans, who, as he ſays, were more liberal with the word Maſter, like our neighbours with Meſſieurs, than the old Germans †; but the Roman watchmen did not call out, nor yet do the French at preſent. If I may be allowed a conjecture on ſo trifling an object, I ſhould ſay that the city ſervants or beadles were the firſt perſons appointed to call out the hours, as was the caſe at Berlin. Theſe therefore called out to their maſters, and "Our maſters" is ſtill the uſual appellation given to the magiſtrates in old cities, particularly in the Empire, and in Swiſſerland. At Gottingen the ancient form was aboliſhed in the year 1791, and the watchmen call out now, "The clock has ſtruck ten, it is ten o'clock."

* From the name of this inſtrument, called in ſome places of Germany a *ratel*, aroſe the appellation of *ratelwache*, which was eſtabliſhed at Hamburgh in 1671. In the Dutch language the words *ratel*, *ratelaar*, *ratelen*, *ratelmann*, *ratelwagter* (a night-watchman) are quite common.

† Gelehrte anzeigen. Halle 1743, 4to. i. p. 488. The author refers to Seneca, epiſt. 3: Quem nos obvium, ſi nomen non ſuccurrit, dominum vocamus.

Watchmen who were ſtationed on ſteeples by day as well as by night, and who, every time the clock ſtruck, were obliged to give a proof of their vigilance by blowing a horn, ſeem to have been eſtabliſhed on a permanent footing, firſt in Germany, and perhaps before watchmen in the ſtreets. In England, there are none of theſe watchmen *; and in general they are very rare beyond the boundaries of Germany. That watchmen were poſted on the tops of towers, in the earlieſt ages, to look out for the approach of an enemy, is well known, and has been ſufficiently proved by Faber, my friend and former pupil †. In the times of feudal diſſenſion, when one chief, if he called in any aſſiſtance, could often do a great deal of hurt to a large city, either by plundering and burning the ſuburbs and neighbouring villages, or by driving away the cattle of the citizens, and attacking ſingle travellers ‡, ſuch precaution was more neceſſary than at preſent. The nobility therefore kept in their ſtrong caſtles watchmen, ſtationed on towers; and this practice prevailed in other countries beſides Ireland and Burgundy ||. It appears by the laws of

* Phyſikal œconom. biblioth. v. p. 294.

† Archæologie der Hebräer. Halle 1773, 8vo. i. p. 181.

‡ Thoſe who have read ancient annaliſts muſt recollect many inſtances of this kind; but at all events they may be found by recurring to *Von Falkenſtein's Hiſtorie von Erfurt.*

|| This is proved by profeſſor Fiſcher in *Sitten der Europäer*

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of Wales, that a watchman with a horn was kept in the king's palace *. The German princes had in their caſtles, at any rate in the ſixteenth century, tower-watchmen, who were obliged to blow a horn every morning and evening †.

At firſt, the citizens themſelves were obliged to keep watch in turns on the church-ſteeples, as well as at the town-gates; as may be ſeen in a police-ordinance of the city of Einbeck ‡ in the year 1573. It was the duty of theſe watchmen, eſpecially where there were no town clocks, to announce certain periods, ſuch as thoſe of opening and ſhutting the city-gates ||. The idea of giving orders

im fünften jahrhunderte. Frankf. 1784, 8vo. p. 96. from the teſtimony of Richard Stanihurſt in *De rebus in Hibernia geſtis*, lib. i. p. 33, and from other works.

* Leges Walliæ. Lond. 1730, fol.

† In *Meiners* and *Spittlers Hiſtoriſches magazin*, i. p. 45, mention is made, in a letter of a landgrave, dated 1561, of a tower-watchman, who was obliged to blow his horn in the caſtle morning and evening.

‡ It may be found in *Daſſeliſche und Eimbeckiſche Chronica, durch Letznerum.* Erfurt 1596, fol. vol. vi. p. 106. The perſon whoſe turn it was to watch at the gates, was obliged to perform the duty himſelf, or to cauſe it to be performed by a ſufficient young citizen. Thoſe who attended to trade, and neglected the watch, paid for every omiſſion one mark to the council. The caſe was the ſame with the watch on the tower in the market-place.

|| Hiſtoriſch-diplomatiſche abhandlung vom urſprung der ſtadt Roſtock, p. 25, 62.

to theſe watchmen to attend not only to danger from the enemy but from fire alſo, and, after the introduction of public clocks, to prove their vigilance by making a ſignal with their horn, muſt have naturally occurred; and the utility of this regulation was ſo important that watchmen on ſteeples were retained even when cities, by the prevalence of peace, had no occaſion to be apprehenſive of hoſtile incurſions.

After this period perſons were appointed for the particular purpoſe of watching; and ſmall apartments were conſtructed for them in the ſteeples. At firſt they were allowed to have their wives with them; but this was ſometimes prohibited, becauſe a profanation of the church was apprehended. In moſt, if not in all, cities, the town-piper, or, as we ſay at preſent, town-muſician was appointed ſteeple-watchman; and lodgings were aſſigned to him in the ſteeple; but, in the courſe of time, as theſe were too high and too inconvenient, a houſe was given him near the church, and he was allowed to ſend one of his ſervants or domeſtics to keep watch in his ſtead. This is the caſe ſtill at Gottingen. The city muſician was called formerly the *hausmann*, which name is ſtill retained here as well as at the Hartz, in Halle, and ſeveral other places; and the ſteeple in which he uſed to dwell and keep watch was called the *hausmann's thurm* *. Theſe eſtabliſh-

* Stiebritz Auszug aus Von Dreyhaupts Beſchreibung des Saal-Creyſes.

eſtabliſhments, however, were not general; and were not every where formed at a period equally early, as will be ſhewn by the proofs which I ſhall here adduce.

If we can credit an Arabian author, whoſe Travels were publiſhed by Renaudot, the Chineſe were accuſtomed, ſo early as the ninth century, to have watchmen poſted on towers, who announced the hours of the day as well as of the night, by ſtriking or beating upon a ſuſpended board *. Marcus Paulus, who, in the thirteenth century, travelled through Tartary and China, confirms this account; at leaſt in regard to a city which he calls Quinſai, though he ſays that ſignals were

Creyſes. Halle 1773, 8vo. ii. p. 44. *Friſch, Teutſches-Wörterbuch. Zeitfuchs, Stolbergiſche hiſtorie;* Frankf. 1717, 4to. p. 59. *Vulpius, Magdeburgiſche geſchichte,* 1702, 4to. p. 300. *Vulpius, Märſeburg* 1700, 4to. p. 33 and 37. In the Berlin police ordinance of the year 1580, which may be found in *Küſters Alte u. n. Berlin,* iii. p. 353, it was ordered that the *raths-thurn oder hausmann*, ſteeple watchman or city muſician, ſhould attend at weddings with muſic for the accuſtomed pay, but only till the hour of nine at night, in order that he might then blow his horn on the ſteeple, and place the night-watch.

* Anciennes relations des Indes et de la Chine. Paris 1718, 8vo. p. 25, 192. The credibility of theſe travels, which are highly worthy of attention, has been of late much confirmed in *Notices des manuſcrits du Roi*, i. p. 157, as they were formerly in *Memoires de l'Académie des Inſcriptions*, xxxvii. p. 477. See alſo *Meuſel's Biblioth. hiſt.* ii. 2. p. 117.

given only in cafes of fire and difturbance *. Such boards are ufed in China even at prefent †; and in Peterfburg the watchmen, who are ftationed at fingle houfes or in certain parts of the city, are accuftomed to announce the hours by beating on a fufpended plate of iron. Such boards are ftill ufed by the Chriftians in the Levant to affemble people to divine fervice, either becaufe they dare not ring bells or are unable to purchafe them. The former is related by Tournefort of the inhabitants of the Grecian iflands ‡, and the latter by Chardin of the Mingrelians ||. The like means

* De regionibus oriental. edit. Mulleri 1671, 4to. p. 120. *Algemeine hiftorie der reifen*, vii. p. 100.

† Martini Atlas Sinenf. p. 17. Matches, or links, to which alarums are fometimes added, are employed in China to point out the hours; and thefe are announced by watchmen placed on towers, who beat a drum. See *Algemeine hiftorie der reifen*, vi. p. 289, 290. *Kæmpfer's Gefchichte und befchreibung von Japan*, ii. p. 28, or the French tranflation *Hiftoire de Japon*, Amfterdam 1732. 12mo. ii. p. 115, where the mention of matches is omitted. *Thunberg's Refa uti Europa, Africa, Afia*, iii. p. 99: "Time is meafured here not by clocks or hour-glaffes, but by burning matches, which are plaited like ropes, and have knots on them. When the match burns to a knot, which marks a particular lapfe of time, the hour is announced, during the day, by a certain number of ftrokes on the bells in the temples; and in the night by watchmen who go round and give a like fignal with two pieces of board, which they knock againft each other."

‡ Voyage du Levant, i. p. 45, where a figure is given of the inftrument, which ftill retains the ancient names explained by Reifke σημαντρον and σημαντηριον.

|| Voyages, edition of Rouen, 12mo. i. p. 180.

were

were employed in monaſteries, at the earlieſt periods, to give notice of the hours of prayer, and to awaken the monks *. Mahomet, who in his form of worſhip borrowed many things from the Chriſtians of Syria and Arabia, adopted the ſame method of aſſembling the people to prayers; but when he remarked that it appeared to his followers to ſavour too much of Chriſtianity, he again introduced the practice of calling out.

The ſteeple-watchmen in Germany are often mentioned in the fourteenth and fifteenth century. In the year 1351, when the council of Erfurt renewed that police ordinance which was called the *zuchtbrief*, letter of diſcipline, becauſe it kept the people in proper ſubjection, it was ordered, beſides other regulations in regard to fire, that two watchmen ſhould be poſted on every ſteeple †. A watchman of this kind was appointed at Merſeburg ‡ and Leiſnig ſo early as the year 1400 ||. In the beginning of the ſeventeenth century the townpiper of Leiſnig lived ſtill in apartments in the

* A great deal of important information, which is as yet too little known, has been collected on this ſubject by Reiſke, on *Conſtantini Lib. de ceremoniis aulæ Byzant.* ii. p. 74.

† Von Falkenſteins Hiſtorie von Erfurt. Erfurt 1739, 2 vol. 4to. i. p. 249.

‡ Vulpius, Geſchichte der Stadt Märſeburg. Quedlinburg, 1700, 4to. p. 37.

|| Kamprads Leiſnigker chronika. Leiſnig 1753, 4to. p. 390.

ſteeple.

ſteeple. In the year 1563, a church-ſteeple was erected in that place, and an apartment built in it for a permanent watchman, who was obliged to announce the hours every time the clock ſtruck *.

In the fifteenth century the city of Ulm kept permanent watchmen in many of the ſteeples †. In the year 1452 a bell was ſuſpended in the tower of the cathedral of Franckfort on the Mayn, which was to be rung in times of feudal alarm, and all the watchmen on the ſteeples were then to blow their horns and hoiſt their banners ‡. In the year 1476, a room for the watchman was conſtructed in the ſteeple of the church of St. Nicholas ||. In the year 1509, watchmen were kept both on the watch-towers and ſteeples, who gave notice by firing a muſket when ſtrangers approached. The watchman on the tower of the cathedral immediately announced, by blowing a trumpet, whether the ſtrangers were on foot or on horſeback; and at the ſame time hung out a red flag towards the quarter in which he obſerved them advancing.

* Kamprads Leiſnigker chronica, p. 550, 582.

† In turri Beatæ Virginis ſunt ſemper duo cuſtodes, qui mane et veſpere tubis concrepant. Ante paucos annos habebant uxores ſecum ſuperius; ſed Plebanus modernus ejecit feminas propter eccleſiæ emunitatem ſervandam. *Felix Faber* in *Rerum Suevic. ſcriptor.* Ulmæ 1727, fol. p. 79. a. p. 82. b.

‡ Von Lerſners Chronica von Frankf. i. p. 369

|| Ibid. i. p. 20.

The

The ſame watchman was obliged, likewiſe, to blow his horn on an alarm of fire; and that theſe people might be vigilant day and night, both in winter and ſummer, the council ſupplied them with fur-cloaks, ſeven of which, in the above-mentioned year, were purchaſed for ten florins and a half *.

In the year 1496, the large clock was put up in the ſteeple of Oettingen, and a perſon appointed to keep watch on it †. In 1580, Montagne was much ſurpriſed to find on the ſteeple at Conſtance a man who kept watch there continually; and who, on no account, was permitted to come down from his ſtation ‡.

LEAF-SKELETONS.

PLANTS, as well as animals, are organiſed bodies, and like them their parts may be diſſected and decompoſed by art; but the anatomy of the

* Von Lerſners Chronica von Frankf. i. p. 374.

† This is related in the *Oettingiſches Geſchichts-almanach*, p. 7, on the authority of an account in the pariſh-books of Oettingen, ſaid to be extracted from an ancient chronicle of that town. The author of this almanack, which is now little known, was, as I have been told, Schablen, ſuperintendant at Oettingen. I have the edition of 1783, with the calendar. It conſiſts of 232 pages in octavo.

‡ Reiſe, i. p. 180.

former

former has not been cultivated ſo long and with ſo much zeal and ſucceſs as that of animals. Some naturaliſts, about the beginning of the laſt century, firſt began to make it an object of attention, to compare the ſtructure of plants with that of animals; and for that purpoſe to employ the microſcope. Among theſe, two diſtinguiſhed themſelves in a particular manner: Marcellus Malpighi *, an Italian; and Nehemiah Grew †, an Engliſhman; who both undertook almoſt the ſame experiments and made them known at the ſame time; ſo that it is impoſſible to determine which of them was the earlieſt. It appears, however, that Grew publiſhed ſome of his obſervations a little ſooner; but Malpighi was prior in making his known in a complete manner. But even allowing that the one had received hints of the proceſſes of the other, they are both entitled to praiſe that each made experiments of his own, and from theſe prepared figures, which are always more correct the nearer they correſpond with each other.

Among the various helps towards acquiring a knowledge of the anatomy of plants, one of the principal is the art of reducing to ſkeletons leaves, fruit and roots; that is, of freeing them from their ſoft, tender and pulpy ſubſtance, in ſuch a man-

* Haller's Biblioth. botan. i. p. 582.

† Ibid. p. 562.

ner, that one can ſurvey alone their internal, harder veſſels in their entire connection. This may be done by expoſing the leaves to decay for ſome time ſoaked in water, by which means the ſofter parts will be diſſolved, or at leaſt ſeparated from the internal harder parts, ſo that one, by carefully wiping, preſſing and rinſing them, can obtain the latter alone perfectly entire. One will poſſeſs then a tiſſue compoſed of innumerable woody threads or filaments, which, in a multiplicity of ways, run through and interſect each other. By ſufficient practice and caution one may detach, from each ſide of a leaf, a very thin covering, between which lies a delicate web of exceedingly tender veſſels. Theſe form a woody net, between the meſhes of which fine glandules are diſtributed. This net is double, or, at leaſt, can be divided lengthwiſe into halves, between which may be obſerved a ſubſtance that appears as it were to be the marrow of the plant. Perſons who are expert often ſucceed ſo far, with many leaves, as to ſeparate the external covering, on both ſides, from the woody net, and to ſplit the latter into two, ſo that the whole leaf ſeems to be divided into four.

One might conjecture that this method of reducing leaves to ſkeletons muſt have been long known, as one frequently finds in ponds leaves which have dropped from the neighbouring trees, and which by decompoſition, without the aſſiſtance

of

of art, have been converted into ſuch a woody net, quite perfect and entire. It is however certain, that a naturaliſt about the year 1645 firſt conceived the idea of employing decompoſition for the purpoſe of making leaf-ſkeletons, and of aſſiſting it by ingenious operations of art.

This naturaliſt, Marcus Aurelius Severinus, profeſſor of anatomy and ſurgery at Naples, was born in 1580, and died of the plague in 1656 *. In his *Zootomia Democritæa*, printed in 1645, he gave the figure, with a deſcription of a leaf of the *ficus opuntia* reduced to a ſkeleton. Of the particular proceſs employed to prepare this leaf, the figure of which is very coarſe and indiſtinct, he gives no account. He ſays only that the ſoft ſubſtance was ſo diſſolved that the veſſels or nerves alone remained; and that he had been equally ſucceſsful with a leaf of the palm-tree †. A piece of

* Haller's Biblioth. anatom. i. p. 367, where he is called, improperly, profeſſor of anatomy and botany.

† This book was printed at Nuremberg, in quarto, under the inſpection of J. George Volkamer, who became acquainted with the author during his travels, and had obtained from him the manuſcript, in order that it might be publiſhed. The following paſſage occurs, p. 63: E foliis mihi, quod admiratione digniſſimum obtigit, eſt folium ficus opuntiæ, reſolutum parte carnoſa, reſiduis tantummodo venis aut nervis, ſi ſic vocandi ſunt. In p. 65, the author ſays: Ita non diſſimilis venarum vegetabilium, et ſentientium omnium uſus eſt et fabricatio, poſt hanc plantam ſecunda eſt opificio folium, quod primoribus intereſt foliis palmæ. Carne

of a leaf of the like kind he ſent, by Thomas Bartholin, to Olaus Wormius, who cauſed it to be engraved on copper, in a much neater manner, without ſaying any thing of the method in which it had been prepared *. The proceſs Severin kept ſecret; but he communicated it to Bartholin, in a letter, on the 25th of February, 1645, on condition that he would diſcloſe it to no one †. At that period, however, it excited very little attention; and was ſoon forgotten, though in the year 1685 one Gabriel Clauder made known that he had reduced vine-leaves, the calyx of the winter cherry, and a root of hemlock, to a net or tiſſue by burying them in ſand during the heat of ſummer, and hanging them up ſome months in the open air till they were completely dried ‡.

Carne enim ſua reſolutum rectis ſecundum corpus fibris ac tranſverſis contextum eſt ſic, ut ſtamina duplicia linteorum pannorum referat.

* Muſeum Wormianum. Lugd. Bat. 1655, fol. p. 149.

† Bartholini Epiſtolarum medicinal. centuria i. Hagæ Com. 1740, 8vo. p. 269. The following are the words of Severin, who ſeems, indeed, not to have been able to expreſs himſelf in a very clear manner: Verum me ineptum! quid præterieram opuntii folii reſolutionem artificioſam? Parabitur hæc porro ſimplici tabefactu per affuſam uberem aquam, tamdiu complexuram, dum fibris lignea duritie veſtibilibus omnis exſolvatur carnea portio. Quæ tibi ars ad analyſes pleraſque felici ſoli ſervator, nulli præterquam Achati revelanda. Fuit huic fabricæ opificium divinum in Dendranatome mea parva, apud Zootomiam, enarratum.

‡ Ephemerid. Nat, Curioſ. dec. 2. an. 4. p. 285.

This art was conſidered to be of much more importance when it was again revived by the well-known Dutchman, Frederick Ruyſch. That naturaliſt found means to conduct all his undertakings and labours in ſuch a manner, as to excite great wonder; but we muſt allow him the merit of having brought the greater part of them to a degree of perfection which no one had attained before. By the anatomy of animals, in which he was eminently ſkilled, he was led to the diſſection of plants; and as it ſeemed impoſſible to fill their tender veſſels, like thoſe of animals, with a coloured ſolid ſubſtance *, he fell upon a method of ſeparating the hard parts from the ſoft, and of preſerving them in that manner.

* The well-known Sir John Hill, an Engliſhman, has proved, however, in latter times, the poſſibility of injecting a ſubſtance into the veſſels of plants alſo. He diſſolved ſugar of lead in water, ſuſpended in it bits of the fineſt wood, ſo that one-half of them was under water and the other above it, and covered the veſſel in which they were placed with an inverted glaſs. At the end of two days he took the bits of wood out, cut off the part which had been immerſed in the water, dipped them in a warm lye made of unſlaked lime and orpiment, like what was uſed formerly for proving wine; and by theſe means the fineſt veſſels, which had been before filled with ſugar of lead, acquired a dark colour, and their apertures became much more diſtinct. This proceſs he deſcribes himſelf in *The Conſtruction of Timber*, two editions of which were publiſhed in the year 1770, one in folio and the other in octavo. The whole account may be found in the latter, p. 33.

For

For this purpoſe, he firſt tried a method which he had employed, with uncommon ſucceſs, in regard to the parts of animals. He covered the leaves and fruit with inſects, which ate up the ſoft or pulpy parts, and left only thoſe that were hard. But however well theſe inſects, which he called his little aſſiſtants, may have executed their taſk, they did not abſtain altogether from the ſolid parts, ſo that they never produced a complete ſkeleton. He diſmiſſed them, therefore, and endeavoured to execute with his own fingers what he had before cauſed the inſects to perform, after he had ſeparated the ſoft parts from the hard by decompoſition. In this he ſucceeded ſo perfectly, that all who ſaw his ſkeletons of leaves or fruit were aſtoniſhed at the fineneſs of the work, and wiſhed to imitate them.

I cannot exactly determine the year in which Ruyſch began to prepare theſe ſkeletons. Trew thinks that it muſt have been when he was in a very advanced age, or at any rate after the year 1718; for when he was admitted to Ruyſch's collection in that year, he obſerved none of theſe curioſities. Rundmann, however, ſaw ſome of them in his poſſeſſion in the year 1708 *. At firſt Ruyſch endeavoured to keep the proceſs a ſecret, and to evade giving direct anſwers to the queſtions

* Rariora naturæ et artis. Breſlau and Leipſic 1737, fol. p. 421.

of the curious. We are informed by Rundmann, that he attempted to imitate his art by burying leaves at the end of harveſt in the earth, and leaving them there till the ſpring, by which their ſoft parts became ſo tender that he could ſtrip them off with the greateſt eaſe. He produced alſo the ſame effect by boiling them.

The firſt account which Ruyſch himſelf publiſhed of his proceſs, was, as far as I know, in the year 1723. After he had ſufficiently excited the general curioſity, he gave figures of ſome of his vegetable ſkeletons, related the whole method of preparing them, and acknowledged that he had accidentally met with an imperfect engraving of a leaf-ſkeleton in the *Muſeum* of Wormius, which had at one time occaſioned much wonder *. It is not improbable

* Adverſariorum decas tertia. Amſtelod. 1723, 4to. In the preface, and p. 8, 9, 11. Neque latere velim artem, qua arcanum hoc detegitur. Impono illos explorandos fructus aquæ, donec incipiunt putreſcere, deinde vero eos vaſi figulino immitto, cujus fundus planus eſt, ſicque poſitos deglubo lente; excorticatos dein diu agito hinc inde per aquam, ut hoc concuſſu ſolvantur a mutuis complexibus vaſa, ſimul autem blande lenteque comprimo inter digitos, donec incipiat diſſolutio fieri. - - - In Muſæo Wormiano incidi in imperfectam imaginem partis ſceleti opuntiæ, quod doctiſſimi etiam viri tunc temporis valde mirati ſunt, cujuſque meminerunt in ſcriptis ſuis. The many ſmall treatiſes written by Ruyſch, which are mentioned in Haller's *Biblioth. anat.* i. p. 530, have, in part, been printed more than once in quarto, but they are known under the following general title, which Haller forgot

to

improbable that he knew how the Italian, whom he does not mention, though he is mentioned by Wormius, and though he muſt certainly have been acquainted with his *Zootomia*, prepared his ſkeletons. I muſt however obſerve, that it is remarked by thoſe who knew Ruyſch, that he had read few books, and was very little verſed in the literature of his profeſſion.

In the year following, Ruyſch deſcribed more articles of the like kind, and gave figures of ſome pears prepared in this manner *. In 1726, when Vater, profeſſor at Wittenberg, expreſſed great aſtoniſhment at the fineneſs of his works, he replied, in a letter written in 1727, that he had at firſt cauſed them to be executed by inſects, but that he then made them himſelf with his fingers †. He repeated

to give: *Ruyſchii Opera omnia anatomico-medico-chirurgica.* Amſtelod. apud Janſſonio-Waeſsbergios 1721, 4to. Then follow his various treatiſes with diſtinct title-pages, and the different dates when publiſhed. To this collection, which may very conveniently be divided into two volumes, is prefixed *Hiſtoria vitæ et meritorum F. Ruyſchii,* auctore J. F. Schreibero. Amſtel. 1732. At the end there is a complete index to all his writings. *Operum index locupletiſſimus, concinnatus ab Yſbr. Gyſberto Arlebout.* Amſtel. 1725.

* Curæ poſteriores, ſeu Theſaurus anatom. omnium præcedentium maximus, 1724, n. 27, 41, 183, 200, and p. 31, B. tab. 1.

† Abrahami Vateri Epiſt. gratulat. ad Ruyſchium de muſculo orbiculari,

peated the ſame thing alſo in 1728, when he deſcribed and gave engravings of more of theſe curious objects *. The progreſs of this invention is related in the ſame manner by Schreiber, in his Life of Ruyſch.

When the method of producing theſe ſkeletons became publicly known, they were ſoon prepared by others; ſome of whom made obſervations, which were contrary to thoſe of Ruyſch. Among theſe in particular, were J. Bapt. Du Hamel, who ſo early as the year 1727 deſcribed and illuſtrated with elegant engravings the interior conſtruction of a

orbiculari, 1727. In the anſwer printed along with this letter, Ruyſch ſays, p. 16: I have hitherto replied, when aſked how it was poſſible to make ſuch fine works: me non eſſe hujus opificii auctorem, ſed ſatellites meos, puta animalcula, quæ tunc temporis in uſum revocaveram. Nunc vero illud longe nitidius et exquiſitius ipſemet perago, idque propriis ſatellitibus, nempe propriis digitis. Of employing different kinds of inſects, particularly the *dermeſtes*, as they are called, for reducing animal and vegetable bodies to ſkeletons, Hebenſtreit has treated in *Program. de vermibus anatomicorum adminiſtris* to the *Diſputat. de adjumentis ſanguinis ad cor regreſſus*, by Qualmaltz von Troppaneger; Lipſ. 1741. Figures of the inſects and of ſome of their preparations are added.

* Curæ renovatæ, ſeu Theſaurus anat. poſt curas poſteriores novus, 1728; in the preface, and alſo No. 40, 60, 72, 81, 89, 115, 127, 133, 138, and p. 21, No. 4. tab. 1, 2, 3. Some of theſe figures, with an account of the book, were inſerted in *Acta Eruditorum*, 1729, Febr. p. 63.

pear;

pear *; Trew †, in whoſe poſſeſſion Keyſler ſaw ſuch ſkeletons in 1730 ‡; P. H. G. Mohring ||; Seba §; Francis Nicholls ¶, an Engliſhman; profeſſor Hollmann ** at Gottingen, Ludwig ††, Walther ‡‡, Geſner |||, and others. Nicholls ſeems to have been the firſt who ſplit the net of an apple or a pear-tree leaf into two equal parts, though Ruyſch ſplit a leaf of the opuntia into three, four, and even five layers, as he himſelf ſays.

* Memoires de l'Academ. des Sciences, année 1730, 1731, 1732; and tranſlated into Latin in *Commercium litter. Norimberg.* 1735. p. 308; 1736, p. 349; and 1738, p. 6.

† Commerc. litter. Norimb. 1732. p. 73.

‡ Reiſe, p. 1197.

|| Commerc. Norimb. 1733, p. 37.

§ Philoſoph. tranſact. 1730, No. ccccxvi. p. 441; and in the firſt part of his *Theſaurus*.

¶ Philoſoph. tranſ. 1730, No. ccccxiv. p. 371.

** Ibid. No. ccccIxi. p. 789, and No. ccccIxiii. p. 796. *Commerc. litter. Norimb.* 1735, p. 353. *Hollmanni Commentat. ſyllogę.* Gottingæ 1765, 4to. p. 109. In p. 120, the year 1727 muſt undoubtedly be read inſtead of 1734. The papers of Seba and Hollmann may be found tranſlated into Italian in *Scelta d'opuſcoli intereſſanti*, vol. ix. p. 79.

†† Inſtitutiones regni vegetabil. In the part on Leaves.

‡‡ Programma de plantarum ſtructura. Lipſ. 1740, 4to. § 5, 6.

||| Diſſertationes phyſicæ de vegetabilibus, 1740, 1741. Both were reprinted at the ſame time with *Linnæi Orat. de neceſſitate peregrinationum intra patriam.* Lugd. Bat. 1743, 8vo.

In the year 1748, Seligmann, an engraver, began to publiſh, in folio plates, figures of ſeveral leaves which he had reduced to ſkeletons *. As he thought it impoſſible to make drawings ſufficiently correct, he took impreſſions from the leaves or nets themſelves, with red ink, and in a manner which may be ſeen deſcribed in various books on the arts. Of the greater part he gave two figures, one of the upper and another of the under ſide. He promiſed alſo to give figures of the objects as magnified by a ſolar microſcope; and two plates were to be delivered monthly. Seligmann however died ſoon after, if I am not miſtaken; and a lawſuit took place between his heirs, by which the whole of the copies printed were arreſted, and for this reaſon the work was never completed, and is to be found only in a very few libraries.

Cobres ſays, that eight pages of text, with two black, and twenty-nine red copper-plates, were completed. The copy which is in the library of our univerſity, has only eight pages of text, conſiſting partly of a preface by C. Trew, and partly of an account of the author, printed

* Die nahrungs-gefäſſe in den blättern der bäume, nach ihrer unterſchiedlichen austheilung und zuſammenfügung, ſo wie ſolche die Natur ſelbſt bildet, abgedruckt von Johann Michael Seligmann, kupferſtecher in Nürnberg. Nurnberg 1748. See *Gottingiſche Zeitungen von gelehrten ſachen*, 1748, p. 1091. *Haller, Biblioth. botan.* ii. p. 374. *Hamburg Magazin*, iv. p. 93. *Deliciæ Cobreſianæ*, p. 653.

in

in Latin and German oppoſite to each other. Trew gives a hiſtory of the phyſiology of plants and of leaf-ſkeletons; and Seligmann treats on the methods of preparing the latter. The number of the plates however is greater than that aſſigned by Cobres. The copy which is now before me contains thirty-three plates, printed in red; and, beſides theſe, two plates in black, with figures of the objects magnified. Of the ſecond plate in red, there is a duplicate with this title, "Leaves of a bergamot pear-tree, the fruit of which are mild;" but the figures in both are not the ſame; and it appears that the author conſidered one of the plates as defective, and therefore gave another. The leaves repreſented in the plates are thoſe of the orange-tree, lemon-tree, ſhaddock-tree, butcher's-broom, walnut-tree, pear-tree, laurel, lime-tree, ivy, baſtard-quince or meſpilus, cheſnut-tree, maple-tree, holly, willow, white haw-thorn, &c.

I ſhall take this opportunity of inſerting here the hiſtory of the art of raiſing trees from leaves. The firſt who made this art known was Agoſtino Mandirola, doctor of theology, an Italian minorite of the Franciſcan order. In a ſmall work upon Gardening, which, as I think, was printed for the firſt time at Vicenza, in duodecimo, in the year 1652, and which was reprinted afterwards in various places, he gave an account of his having produced trees from the leaves of the cedar and

lemon-trèe *; but he does not relate this circumſtance as if he conſidered it to be a great diſco-

* Many editions of this book may be found mentioned in *Laſtri Bibliotheca georgica*, p. 79; *Halleri Biblioth. botan.* i. p. 484; *Böhmeri Biblioth. hiſt. nat.* iii. 1. p. 679. That in the library of our Univerſity has the following title: *Manuale de' Giardinieri, diviſo in tre libri - - - di F. Agoſtino Mandirola. Aggiuntovi il quatro libro, che dimoſtra la qualita e virtu - - - de' fiori deſcritti in queſto volume.* Venetia 1684. 12mo. The account to which I allude occurs lib. iii. cap. 5. p. 133. I ſhall tranſcribe it entirely, as the original in Germany is exceedingly ſcarce: Con un artificio ſimile per via di ſtillicidio hò provato piantar le foglie di cedri, di limoni e di ſimili in queſto modo: hò preſo un vaſo pieno di buoniſſima terra ſottile e graſſa, poi intorno all' orificio vi hò poſto le foglie con il gambo ſotto terra tanto che reſti meza la foglia ſopra; poſcia hò fatto un' orcioletto d'acqua che a ſtilla inaffiaſſe eſſe foglie, al modo detto di ſopra, aggiongendovi ſempre terra nel ſcavo dell'acqua, et in tal modo hanno fatto preſa, e gettato fuora le vergelette in breve tempo.—According to Laſtri, the lateſt edition was printed at Rovoredo in 1733. 12mo. In the year 1765 a French tranſlation appeared, at Paris, under the title of *Manuel du Jardinier - - - par le Sieur Mandirola, traduit ſur l'original Italien par* M. C. L. F. Randi, 455 pages, large duodecimo. To this edition is prefixed a letter from Mandirola, at Florence, in the year 1764, to the tranſlator, in which it is ſaid that the former had ſent him large additions. An evident impoſture! The firſt book is a literal tranſlation from the Manuale of Mandirola. What follows is taken, as I think, from *Inſtruction pour la culture des fleurs*, which is printed at the end of *Quintiny's Jardinier parfait*; but which, however, was not written by him. The French tranſlator has entirely omitted the ingenious account of raiſing trees from leaves. In Haller and Böhmer the French tranſlator is improperly called *Fraudi*. I muſt remark alſo that Agricola, Munchhauſen and others call the Italian author, erroneouſly, Miran-dola.

very.

very. On the contrary, he appears rather to think it a matter of very little importance. His book was ſoon tranſlated into German *; and the above account was copied by other writers, ſuch as Böckler † and Hohberg ‡, who were at that time much read. A gardener of Augſburg, as we are told by Agricola, was the firſt who imitated this experiment, and proved the poſſibility of it to others. He is ſaid to have tried it with good ſucceſs in the garden of count de Wratiſlau, embaſſador at Ratiſbon from the elector of Bohemia.

But never was this experiment ſo often and ſo ſucceſsfully repeated as in the garden of baron de Munchhauſen, at Swobber. A young tree was obtained there from a leaf of the *Limon a Rivo*, which produced fruit the ſecond year. It was ſent to Mr. Volkamer, at Nuremberg, who cauſed a drawing to be made from it, which was afterwards engraved, in order that it might be publiſhed in the third volume of his *Heſperides;* but as the author died too early, it was not printed. The

* Mandirola, Italieniſcher baum- blumen- und pomeranzengärtner. Nurnberg 1670. 12mo; and at the ſame place 1679. 12mo. The firſt edition is inferior, as the other contains ſome notes by the editor.

† Georg. Andr. Boeklers Haus- und feld-ſchule, i. 26.

‡ Georgica curioſa, i. p. 778.

exact

exact drawing, as it was then executed at Nuremberg, and an account of the whole proceſs employed in the experiment at Swobber, have been publiſhed by the baron de Munchhauſen himſelf, from authentic papers in his grandfather's own writing *.

No one, however, excited ſo much attention to this circumſtance as the well-known George Andrew Agricola, phyſician at Regenſburg (Ratiſbon), who, with that confidence and prolixity which were peculiar to him, ventured to aſſert, that trees could be propagated in the ſpeedieſt manner by planting the leaves, after being ſteeped in a liquor which he had invented; and for the truth of his aſſertion he referred to his own experiments †. Among the naturaliſts of that period none took more trouble to examine the poſſibility of this effect than Thummig ‡, who endeavoured to prove that not only leaves with eyes left to them, could, in well moiſtened earth, throw out roots which would produce a ſtem, but that leaves alſo without eyes would grow up to be

* Hausvater, vol. v. p. 662.

† Verſuch der univerſal-vermehrung aller bäume. Regenſb. 1716. fol. p. 107, 157; or in the neweſt edition by Brauſer. Regenſb. 1772. fol. i. p. 97; and ii. p. 41.

‡ Thummigii Meletemata. Brunſw. et Lipſ. 1727. 8vo. p. 5. *Thummigs Erläuterung der begebenheiten in der natur.* Marburg 1735. 8vo. p. 101.

trees.

trees. Baron Munchhauſen, on the other hand, aſſures us, that according to the many experiments made in his garden, one can expect young plants from the leaves of thoſe trees only which do not bring forth buds; that experiments made with the leaves of the lemon-tree had alone ſucceeded, but never thoſe made with the leaves of the orange or lime-tree; and that Agricola and Thummig had erroneouſly imagined that the leaves themſelves ſhot up into trees, their middle fibre *(rachis)* becoming the ſtem, and the collateral fibres the branches. But the leaf decays as ſoon as it has reſigned all its ſap to the young tree, which is ſpringing up below it.

To conclude: It is probable that the well-known multiplication of the Indian fig, or *opuntia*, gave the firſt idea of this experiment; for every joint of that plant, ſtuck into the earth, and properly nurtured, throws out roots and grows. As theſe joints were commonly conſidered to be leaves, people tried whether other leaves would not grow in the like manner. Luckily, thoſe of the lemon-tree were choſen for this purpoſe; and what was expected took place. Thus from a falſe hypotheſis have new truths often been derived; and thus was Kepler, by a falſe and even improbable opinion, led to an aſſertion, afterwards confirmed, that the periodical revolutions of the planets were in proportion to their diſtance from the ſun. But

the raiſing of trees from leaves was too raſhly declared to be a method that might be generally employed; for it is certain that it now ſeldom ſucceeds.

BILLS OF EXCHANGE.

I SHALL not here repeat what has been collected by many learned men reſpecting the important hiſtory of this noble invention, but only lay before my readers an ordinance of the year 1394, concerning the acceptance of bills of exchange, and alſo two bills of the year 1404, as they may ſerve to illuſtrate farther what has been before ſaid on the ſubject by others. Theſe documents are, indeed, more modern than thoſe found by Raphael de Turre* in the Writings of the juriſt Baldus †, which are dated March the 9th 1328; but they are attended with ſuch circumſtances as ſufficiently prove that the method of tranſacting buſineſs by bills of exchange was fully eſtabliſhed ſo early as the fourteenth century; and that the preſent form and terms were even then uſed. For this important information I am in-

* Diſp. i. quæſt. 4. n. 23.

† Conſil. 348.

debted

debted to Mr. Von Martens, who found it in a book which, as far as I know, has never been noticed in any Literary Journal, though it is much more deſerving of attention than many others better known. It is a Hiſtory, written in Spaniſh, of the maritime trade and other branches of commerce at Barcelona, taken entirely from the archives of that city, and accompanied with documents from the ſame ſource, which abound with matter highly intereſting *.

Among theſe is an ordinance iſſued by the city of Barcelona in the year 1394, that bills of exchange ſhould be accepted within twenty-four hours after they were preſented; and that the ac-

* Memorias hiſtoricas ſobre la marina commercio y artes de la antigua ciudad de Barcelona, por D. Antonio de Capmany y de Montpalau. Madrid 1779. 2 vol. 4to. As a proof of what I have ſaid above, I ſhall mention the following important articles, which may be found in this work. A cuſtom-houſe tariff, written in Latin, of the year 1221, in which occur a great number of remarkable names and articles of merchandiſe not explained. Another of the like kind of the year 1252. Letters of power to appoint conſuls in diſtant countries, ſuch as Syria, Egypt, &c. dated in the years 1266, 1268, and 1321. An ordinance of the year 1458, reſpecting Inſurance, which required that under-writing ſhould be done in the preſence of a notary, and declared *polices ò ſcriptures privades* to be null and void. A *privilegium* of the emperor Andronicus II. to the merchants of Barcelona, written in Greek and Spaniſh, in 1290. Account of the oldeſt Spaniſh trade with wool, ſilk, ſalt and ſaffron; and of the oldeſt guilds or incorporated ſocieties of tradeſmen at Barcelona, &c.

ceptance ſhould be written on the back of the bill *.

In the year 1404, the magiſtrates of Bruges, in Flanders, requeſted the magiſtrates of Barcelona to inform them what was the common practice, in regard to bills of exchange, when the perſon who preſented a bill raiſed money on it in an unuſual manner, in the caſe of its not being paid, and by theſe means increaſed the expences ſo much that the drawer would not conſent to ſuſtain the loſs. The bill which gave occaſion to this queſtion is inſerted in the memorial. It is written in the ſhort form ſtill uſed; which certainly ſeems to imply great antiquity. It ſpeaks of uſance; and it appears that firſt and ſecond bills were at that time drawn, and that when bills were not accepted, it was cuſtomary to proteſt them †.

My

* Vol. ii. p. 382.

† As this article is of great importance I ſhall here tranſcribe it, from vol. ii. p. 203: Cum de menſibus Aprilis et Maii ultimo elapſis Antonius Quarti, mercator Lucanus reſidens in villa Brugenſi, a Joanne Colom, mercatore civitatis Barchinonae, etiam reſidente in praedicta villa Brugenſi, duo millia ſcutorum Philippi, quolibet ſcuto pro xxii groſſis computato, ſolvendi per Franciſcum de Prato mercatorem Florentiae, more ſolito, in Barchinona, mediatim Petro Gilberto et Petro Olivo, et mediatim Petro Scorp, et ſupradicto Petro Gilberto, mercatoribus Cardonae: prout de dictis cambiis apparet quatuor litteris papireis, quarum tenores ſubſequuntur.

Superſcriptio autem primae litterae fuit talis: *Franc. de Prato & comp. à Barſelona.* Tenor vero eiuſdem ad intra fuit talis:

Al

My learned readers will here, no doubt, expreſs a wiſh of ſeeing a complete tranſlation of this curious and important work, though with the leſs hope of its being gratified, as ſuch labour muſt require

Al nome di Dio, Amen. à di xxviii. *Aprile* 1404. *Pagate per queſta prima di camb. à uſanza à Piero Gilberto, è Piero Olivò ſcuti mille à ſold.* x. *Barſeloneſi per ſcuto, i quali ſcuti mille ſono per cambio che con Giovanni Colombo à groſſi* xxii. *di g. ſcuto: & pag. à noſtro conto, & Chriſto vi guardi.* Subtus vero erat ſcriptum: *Antonio Quarti Sal. de Bruggias.*

Superſcriptio vero ſecundae litterae fuit talis: *Franciſco de Prato & comp. à Barſalona.* Et ab intra ſic habebatur: *Al nome de Dio, Amen. à di* xviii. *di Magio* 1404. *Pagate per queſta prima di camb. à uſanza à Piero Gilberto & à P. de Scorpo ſcuti mille de Felippo à ſold.* x. *Barſeloneſi per ſcuto: i quali ſcuti mille ſono per camb. che con Giov. Colombo à groſſi* xxii. *di g. ſcuto: & pag. à noſtro conto: & Chriſto vi guardi.* Subtus vero erat ſic ſcriptum: *Ant. Quadri Sal. de Bruggias.*

Et ita ſit, quod ſupra dicta cambia, per ſupra dictum Franc. de Prato, aut aliquem alium ſuo nomine, ſoluta minime fuerint, et ex illius defectu, et praecipue ex eo quod Guilh. Colom, vt procurator ſupradictorum P. Gilberti, P. Olivo et P. Scorp. emit ſupratacta duo millia ſcutorum in praedicta civitate Barchinonae in promptis et paratis denariis, expenſis vt praetendit ipſius Ant. Quarti; certa coram nobis orta ſit queſtio inter ſupradictos Jo. Colom ex vna parte, et Ant. Quarti ex altera, dicente eodem Antonio, quod ipſe Guil. Colom, vt procurator praedictus, praedicta inſolutione non obſtante, non debebat, ſumptibus et expenſis ipſius Antonii, ſupradictas pecuniarum ſumas emere in ipſa civitate Barchinonae in promptis et paratis pecuniis, ſed ſolum debuiſſet illas cepiſſe ibidem in Tabulis, prout hoc dicit in tali caſu moris et conſuetudinis eſſe, et ab antiquo fuiſſe in ipſa civitate Barchinonae. Et ipſi cuſtus et expenſae, pro illis duobus millibus ſcutorum modo praedicto factae, in multo excedunt cuſtus dictorum cambiorum,

require not only a knowledge of the Spaniſh language, but alſo of the hiſtory of trade, and of maritime and commercial laws. I find the greater pleaſure, therefore, in informing them that Mr. Von Martens has reſolved to undertake this taſk.

cambiorum, ſi eadem capta fuiſſent ibidem in Tabulis: aſſerit ſaepe dictus Antonius, ſe illa praeciſſe dampna Tabularum et non ampliora debere portare, ſupradicto Jo. Colom dicente contrarium, et quod iuxta proteſtationum litteras ſuper hoc ſuo tempore factas, praedictus Antonius tolerare debet et ſolvere omnes expenſas et intereſſe, quod ex defectu dictae ſolutionis, per emptionem dictarum pecuniarum vel alias factae ſunt, et de illis eundem Johannem reddere indempnem. - - - The *Tabula* here mentioned was eſtabliſhed in 1401, and ſeems to have been the commencement of banks for paper-money, the firſt imitation of which was that formed at Genoa in 1407. I hope I ſhall merit thanks from my readers for adding the following information taken from the before-mentioned work, vol. i. p. 213. Eſte banco del cambio ò tabla, que al principio ſe llammò *Taula de cambi*, y eſtaba aſegurado con el credito y las rentas publicas de la ciudad, fuè eſtablecido primeramente en la caſa de la Lonja, y era adminiſtrado por commerciantes, cuyos oficios de adminiſtradores, tenedores de libros y otros elegia y tenia dotados la ciudad de ſu erario proprio. Eſte util eſtablecimiento fuè adquiriendo cada dia mayor ſolidez en virtud de los varios reglamentos deſde ſu fundacion haſta principios de eſte ſiglo, que fuè quando céſo el giro del cambio y la circulacion mercantil que tenian ſus fondos. - - - Eſta tabla, ſegun la primitiva forma y metodo de ſu inſtitucion, ſe cuſtodian y aſeguran ſin premio todos los caudales de comunidades y particulares en qualquiera eſpecie de moneda corriente, abonandola con las debidas circunſtancias de ſu valor intrinſeco. En ella ſe hacen pagos y depoſitos por toda eſpecie de perſonas: de modo que por los medios autorizados y autenticos que dimanan de las formalidades de dicha tabla quedan afianzadas la verdad y legitimidad de los creditos, y aſegurada la confianza de los particulares.

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